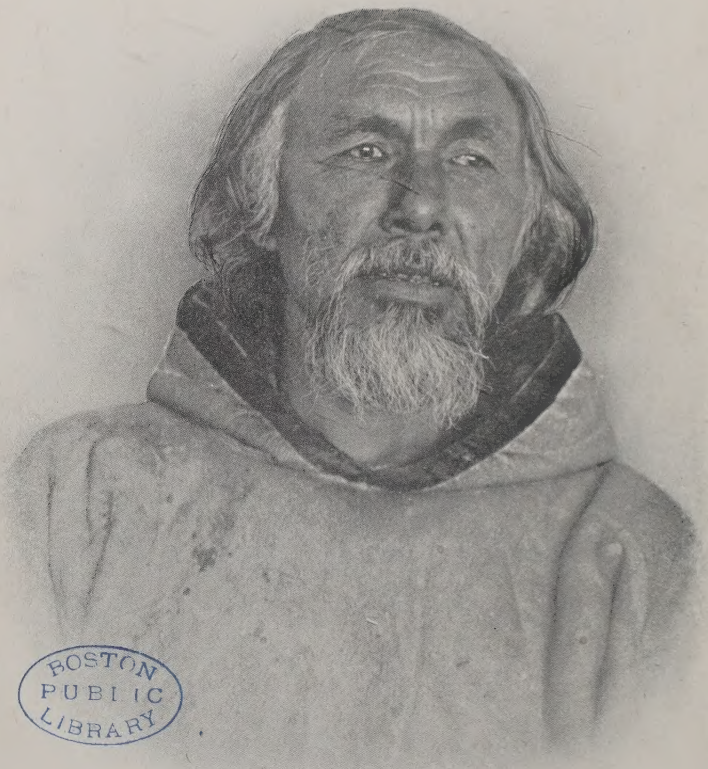
№ F 1060.9.C221

PURCHASED FROM THE INCOME OF THE
JOSIAH H. BENTON FUND

CRUISE OF THE NEPTUNE


BOSTON
PUBLIC
LIBRARY

The Chief of the Aivillingmiut.

Canada. Dept. of marine and fisheries

REPORT

ON THE

DOMINION GOVERNMENT EXPEDITION

TO

HUDSON BAY AND THE ARCTIC ISLANDS

ON BOARD THE

D. G. S. NEPTUNE

1903 - 1904

BY

A. P. LOW, B.Sc., F.R.G.S.

Officer in charge.

OTTAWA
GOVERNMENT PRINTING BUREAU
1906

458

F 1060
.9
.C221

Josiah H. Benton Fd.
Oct. 3, 1939
OA

Ottawa, September 8, 1905.

Hon. Raymond Préfontaine, K.C.,
Minister of Marine and Fisheries.

Sir,—I have the honour to submit herewith my report on the expedition to Hudson Bay and northward thereof, in the steamship *Neptune;* to which, on your kind recommendation, I was appointed officer in charge by a commission authorized under an order in council of August 13, 1903.

Permit me to here acknowledge the kindly and valuable assistance afforded me by Colonel F. Gourdeau, Deputy Minister of the Department of Marine and Fisheries, by Commander G. O. V. Spain, and by all the officers of the department at Ottawa and Halifax, with whom it was my duty and privilege to work.

The greater part of the credit for the complete and successful accomplishment of all the instructions for the voyage is due to Captain S. W. Bartlett, the officers and the crew of the *Neptune.* Their prompt and cheerful attention to orders and their willing co-operation in all matters relating to the expedition deserve the highest praise.

I have great pleasure in calling attention to the valuable work of the scientific staff of the expedition. Dr. L. E. Borden, by his skill and attention, kept everybody in a good general state of health, and in addition rendered great assistance in the collection of specimens and data relating to ethnology, botany and zoology. Mr. Andrew Halkett, Naturalist of the Department of Marine and Fisheries, was indefatigable in the work of collecting specimens in all branches of natural history. Mr. C. F. King, who was attached from the staff of the Geological Survey, took charge in an able manner of the topographical work, and was willingly assisted by Messrs. Caldwell and Ross and by the officers of the ship.

In the preparation of this report, I have received much valuable assistance from Dr. Robert Bell, Acting Director of the Geological Survey, who has not only helped personally, but who also kindly allowed the very necessary assistance of the following members of the staff of that department: Mr. J. M. Macoun, who named and described the plants in the collections brought home; Mr. L. Lambe and Dr. H. M. Ami, who determined and named the collections of fossils, and Mr. F. Nicolas, who kindly edited the report and prepared the index to it. The map which accompanies the report was prepared under the direction of Mr. C. O. Senécal by Messrs. C. F. King and P. Frereault.

My thanks are due to Mr. W. McMahon, Superintendent of Printing, for his kindly advice and assistance in the publication of this report, and it is entirely due to him that the volume presents its creditable appearance.

I have the honour to be, sir,

Your humble servant,

A. P. LOW.

CANADA.

EDWARD THE SEVENTH, by the Grace of God, of the United Kingdom of Great Britain and Ireland, and of the British Dominions beyond the Seas, King, Defender of the Faith, Emperor of India, etc.

To ALBERT PETER LOW, of the City of Ottawa, in the Province of Ontario, in our Dominion of Canada, Esquire,—

GREETING:

E. L. NEWCOMBE,
Deputy of the Minister of Justice,
Canada.

KNOW you that reposing trust and confidence in your loyalty, integrity and ability, We have constituted and appointed, and We do hereby constitute and appoint you the said ALBERT PETER LOW to be officer in charge of the expedition to Hudson Bay and northward thereof in the Steamship *Neptune*,—

To have, hold, exercise and enjoy the said office of officer in charge of the expedition to Hudson Bay and northward thereof in the Steamship *Neptune* unto you the said ALBERT PETER LOW, with all and every the powers, rights, authority, privileges, profits, emoluments and advantages unto the said office of right and by law appertaining during pleasure.

IN TESTIMONY WHEREOF, We have caused these Our Letters to be made Patent, and the Great Seal of Canada to be hereunto affixed. WITNESS, Our Right Trusty and Well-beloved Cousin and Councillor the Right Honourable Sir GILBERT JOHN ELLIOT, Earl of Minto and Viscount Melgund of Melgund, County of Forfar, in the Peerage of the United Kingdom, Baron Minto of Minto, County of Roxburgh, in the Peerage of Great Britain, Baronet

of Nova Scotia, Knight Grand Cross of Our Most Distinguished Order of St. Michael and Saint George, etc., etc., Governor General of Canada.

At Our Government House, in Our City of Ottawa, this Thirteenth day of August, in the year of Our Lord one thousand nine hundred and three, and in the third year of Our Reign.

By Command,

P. PELLETIER,
Acting Under Secretary of State.

CONTENTS.

CHAPTER I.

VOYAGE TO THE BAY.

Page.

Introductory—Preparations—The *Neptune*—The Crew—Coast of Labrador — Port Burwell — Cumberland Gulf — Hudson Strait — Walrus Hunting—Hudson Bay—West Coast of Hudson Bay—Chesterfield Inlet—Arrival at Fullerton.. 1

CHAPTER II.

WINTER QUARTERS AT FULLERTON.

Fullerton Harbour—Preparations for Winter—Natives—Amusement and Work—Spring Explorations—Mr. Caldwell's Trip to Wager Inlet—Surveys about Fullerton—Exploration of Coast to Chesterfield Inlet—Trip in Whaleboats to Southampton Island.. 25

CHAPTER III.

SUMMER CRUISE OF THE *NEPTUNE*.

Fisher Strait—Ice in Hudson Strait—Supply Ship at Port Burwell—Voyage North—North Greenland Coast—Parker Snow Bay—Smith Sound—Crossing to Cape Sabine—Peary's Headquarters—*Neptune* on the Rocks—Taking Possession of Ellesmere Island—East Coast of Ellesmere—Lancaster Sound—Franklin's Headquarters at Beechey Island—Record of the *Gjoa*—Port Leopold—Ponds Inlet—Natives—Arctic Salmon—Baffin Bay—Cumberland Gulf—Wakeham Bay—Sugluk Bay—Salisbury Island—Voyage Home.. 35

CHAPTER IV.

HISTORICAL SUMMARY.

Frobisher—Davis—Weymouth—Knight—Hudson—Button—Baffin — Munck—Fox and James—Hudson's Bay Company—Knight—Middleton and Dobbs—Hearne—Ross and Parry—Parry and Liddon—Parry and Lyon—Franklin—Ross—Back—Dease and Simpson—Rae—Franklin and Crozier—The Franklin Search—Kane—Hayes—Hall—Nares—Markham—Greely—Nansen—Peary—Sverdrup.. 71

CHAPTER V.

ARCTIC ISLANDS.

Page.

Divisions—Physical Features dependant upon Geology—Islands of Hudson Bay—Baffin and Bylot Islands—Islands south of Lancaster Sound —Ellesmere—North Devon—The Parry Islands—The Sverdrup Islands.. 112

CHAPTER VI.

ESKIMOS.

The Central Eskimos—Annual Routine—Winter Months—Snowhouses —Cooking Utensils—Dog Sled—Dogs—Seal Hunting—Seal Spear— Foxes—Trade—Spring Occupations—Summer—Summer Tent—Kyak— Umiak—Harpoon—Caribou Hunting.. 131

CHAPTER VII.

ESKIMOS—*Continued.*

Manners and Customs—Government—Marriage and Divorce—Murder— Death—Burial—Superstitions and Beliefs—The Goddess Nuliavok— Origin of Races—Future State—Taboos—The Angekok—Amusements —Garments—Adornments—Moral Characteristics.. 162

CHAPTER VIII.

GEOLOGY.

Sources of Information—Succession of the Rocks—Earth Movements— Archæan Backbone—Silurian Sea—Devonian and Carboniferous Uplift —Mesozoic and Miocene Tertiary—The Glacial Period—Details of Geology—Archæan—Hudson Bay, Baffin Island, Islands of Group III., Ellesmere and North Devon Islands.. 183

CHAPTER IX.

GEOLOGY—*Continued.*

Silurian—West Coast of Hudson Bay, Baffin Island, Islands of Group III., Northeast Part of Ellesmere, Jones Sound, North Devon Island, Devonian. Carboniferous—Parry Island, Coal, Ellesmere Island Mesozoic—Parry and Sverdrup Islands. Tertiary—Banks Island, Ellesmere Island, Coal, Baffin Island. Glacial—Distribution of Boulders— Ice Movements—Hudson Strait, West Coast of Hudson Bay, Labrador, Greatest Intensity of Ice-cap—Marine Terraces. Economic Minerals Gold, Silver, Copper, Iron, Mica, Graphite, Molybdenite, Lignite and Coal.. 210

CHAPTER X.

WHALING.

Page.

History—The Whaling Fleet—Whaling in Davis Strait and Baffin Bay—Whaling in Hudson Bay—The Right Whale—Whalebone—Scottish Whalers—Ships and Methods—American Whalers—Ships, Crews and Methods—Whaleboats—Spring Whaling—Whaling Stations—Future of the Industry—Other Whales—Porpoises—The Seals—Walrus.. 248

CHAPTER XI.

NAVIGATION OF HUDSON BAY.

Need of Hudson Bay Route—Historical—Navigation of Hudson Strait—Navigation in Hudson Bay—Ports—Currents—Ice from Davis Strait—Ice in Hudson Bay—Period of Navigation—Sailing Directions Trade—Natural Resources—Advantages of Hudson Bay Route—Storage of Grain—Railway.. 283

APPENDIX I.

Meteorological Observations taken on the *Neptune*.. 300

APPENDIX II.

List of Birds and Eggs collected on the Voyage.. 314

APPENDIX III.

List of Plants collected in 1904.. 320

APPENDIX IV.

Notes on the Fossils collected on the Voyage.. 322

APPENDIX V.

List of the principal Works and Papers consulted in the Preparation of the Report.. 337

APPENDIX VI.

Notes on the Physical Condition of the Eskimos.. 343

LIST OF ILLUSTRATIONS.

Page.

The Chief of the Aivillingmiut.. .. ..*Frontispiece*
A Davis Strait Iceburg.. 1
Neptune and *Era*, Fullerton harbour.. 4
Crew of the *Neptune* in winter costume.. 6
Head of Nachvak bay, Labrador.. 8
Port Burwell at eastern entrance to Hudson strait.. 10
Blacklead island, Cumberland gulf.. 12
Kekerten harbour, Cumberland gulf.. 14
Walrus in Smith Sound.. 16
Fullerton harbour.. 18
Wreck camp, Chesterfield inlet.. 22
Neptune in winter quarters.. 24
Southampton island.. 25
Snowhouses on ice near *Neptune*.. 28
Hauling the winter water supply.. 30
Mr. Caldwell starting North.. 32
American Whaleboats in Roes Welcome.. 34
A Greenland Iceberg.. 35
Midnight in Smith sound.. 36
Ice off Cape Wolstenholme.. 40
Parker Snow bay, North Greenland.. 42
A Glacier of Bylot island 44
Cape Herschel, Ellesmere island.. 46
Franklin Monument at Beechey island.. 52
Provisions left for the *Gjoa* at Port Leopold.. 54
Cliffs of Bylot island.. 58
Eskimo Encampment at Ponds inlet.. 60
Women's Boat at Wakeham bay.. 64
South coast of North Devon island.. 71
At Beechey island.. 96
Frenchman Cove, Cyrus Field bay.. 112
Head of Cyrus Field bay, Baffin island.. 120
Shore of Cumberland gulf from Blacklead island.. 122
Kenipitu from Chesterfield inlet.. 130
Lower Encampment, Chesterfield inlet.. 131
Eskimos at Blacklead, Cumberland gulf.. 136
Aivillik Women at Fullerton.. 140
Snowhouses at Fullerton.. 142
Interior of Snowhouse at Fullerton.. 144
Loaded Sleds from Chesterfield inlet.. 146
A Small Team and a Heavy Load.. 148
Interior of Snowhouse at Fullerton.. 150
Eskimo kyak off Cape Haven.. 154
Summer Tents at Wakeham bay.. 158
At Ponds inlet.. 162

Page.
Aivillik Woman in gala dress.. 168
Nechillik Woman.. 170
Kenipitu Belles at Fullerton.. 176
Kenipitu Woman in winter dress.. 178
Upper Encampment, Chesterfield inlet.. 182
Contorted Gneiss and Granite at Fullerton.. 196
Cape Haven harbour.. 202
Scottish Whalers in Ponds inlet.. 210
Limestone Cliffs of North Devon island.. 220
Scottish Whaler *Eclipse*.. 248
Crew of the American Whaler *Era*.. 250
Bundles of whalebone on the *Era*.. 260
Preparing for Spring Whaling.. 264
Whaleboats on the ice, in Roes Welcome.. 268
Scottish whaling station at Blacklead island.. 270
The Launch.. 283
Rafted Ice in Roes Welcome, June, 1904.. 290
Ice in Cumberland gulf, September, 1904.. 292

SHIP'S COMPANY.

SCIENTIFIC STAFF.

A. P. Low, Commander and Geologist.
L. E. Borden, M.D., Surgeon and Botanist.
G. B. Faribault, M.D., Assistant-Surgeon.
A. Halkett, Naturalist.
C. F. King, Topographer and Meteorologist.
G. F. Caldwell, Photographer.

OFFICERS AND CREW.

S. W. Bartlett, Master.
J. Hearn, First Mate.
M. Bartlett, Second Mate.
L. Guay, Third Mate.
W. Aldred, Cook.
J. Harding, Second Cook.
H. Borgle, Steward.
D. Tierney, Second Steward.
M. Ross, Purser.
M. Ryan, Carpenter.
C. King, Boatswain.
J. Clark, Seaman.
J Murphy, "
C. Pomeroy, "
F. Wells, "
W. Babstock, Seaman.
F. Kearny, "
W. Crossman, First Engineer.
J. Crossman Second Engineer.
S Bruchett, Third Engineer.
J. Killey, Fireman.
A Romaine, "
M. Baldwin, "
F. Froude, "
G. Willis, "
J. Rousseau, Boy.
L. Deschesneau, "
E Bourque, "
J. Gouin, "
F. O'Connell, "

NORTH-WEST MOUNTED POLICE.

Major J. D. Moodie, Acting Commissioner.
Staff Sergeant Dee.
Constable Tremaine.
" Jarvis.
" Connelly.
" Donaldson.

H. Ford, who had served as Eskimo interpreter on the *Diana* in 1896, was again engaged in that capacity, at Port Burwell, on the way north.

A Davis Strait Iceberg.

CHAPTER I.

VOYAGE TO THE BAY

The present report contains a narrative of the voyage of the D.G.S. *Neptune*, during the seasons 1903-04, to the northern parts of Hudson bay, and to the northeastern Arctic islands. Following this, under their respective headings, are a short historical account of earlier explorations and discoveries in northeastern Arctic America; a geographical sketch, together with summaries of what is at present known of the inhabitants and geology of the unorganized northeastern territories of the Dominion; short descriptions of the important whaling and sealing industries; and opinions as to the possible navigation of Hudson strait and Hudson bay.

The appendices contain the meteorological observations taken on the voyage, interesting notes on the thickness and growth of the ice; also lists of the birds, plants and fossils collected in these northern regions. All the collections, except that of the marine invertebrates, have been fully determined. The amount of new material in the latter required greater time for study than could be given before the publication of this report, and the results will be included in a future publication.

This report is based largely upon the knowledge obtained, during the voyage, by the scientific staff of the expedition; this has been freely supplemented by information taken from the reports of previous northern explorations. For the convenience of the reader, constant references are not made to these authorities in the text, a list of them being given in an appendix.

Special mention is here made of the indebtedness of the author to the valuable information contained in the works of Richardson, McClintock, Dawson, Bell and Sverdrup.

The accompanying map has been compiled by Mr. C. Frank King. It contains all the corrections to coastline made from his surveys. The ship's track marked on the map will be found convenient in following the text of the narrative.

All bearings mentioned in the text refer to the true North, on account of the confusion arising from the great change in the variation of the compass at different localities included in the area covered by the report. For example, at Chesterfield inlet the compass points true North; while at Beechey island, in Lancaster sound, the variation amounts to 160 degrees, so that the north end of the needle points south-southwest.

The illustrations in the text of the report are from photographs taken by the author.

Acknowledgment is made of the kindness of Admiral Sir Arch. L. Douglas for his willing assistance in fitting out the

Neptune at Halifax, where suitable Welsh coal and a fine steam launch, on his recommendation, were supplied by the Admiralty.

To Captain George Comer, of the American whaler *Era,* special thanks are due for his uniform kindness and courtesy during our long winter together, and for the valuable assistance rendered, by advice, information and services, to the expedition and to myself, personally.

The writer gratefully acknowledges a large amount of interesting details relating to the natives, whaling industry, geography and natural history obtained from the Rev. Mr. Peck, and from the Scottish whaling Captains Milne, Adams, Guy and Murray.

PRELIMINARIES TO AND PREPARATIONS FOR THE VOYAGE.

The Dominion government, in the spring of 1903, decided to send a cruiser to patrol the waters of Hudson bay and those adjacent to the eastern Arctic islands; also to aid in the establishment, on the adjoining shores, of permanent stations for the collection of customs, the administration of justice and the enforcement of the law as in other parts of the Dominion.

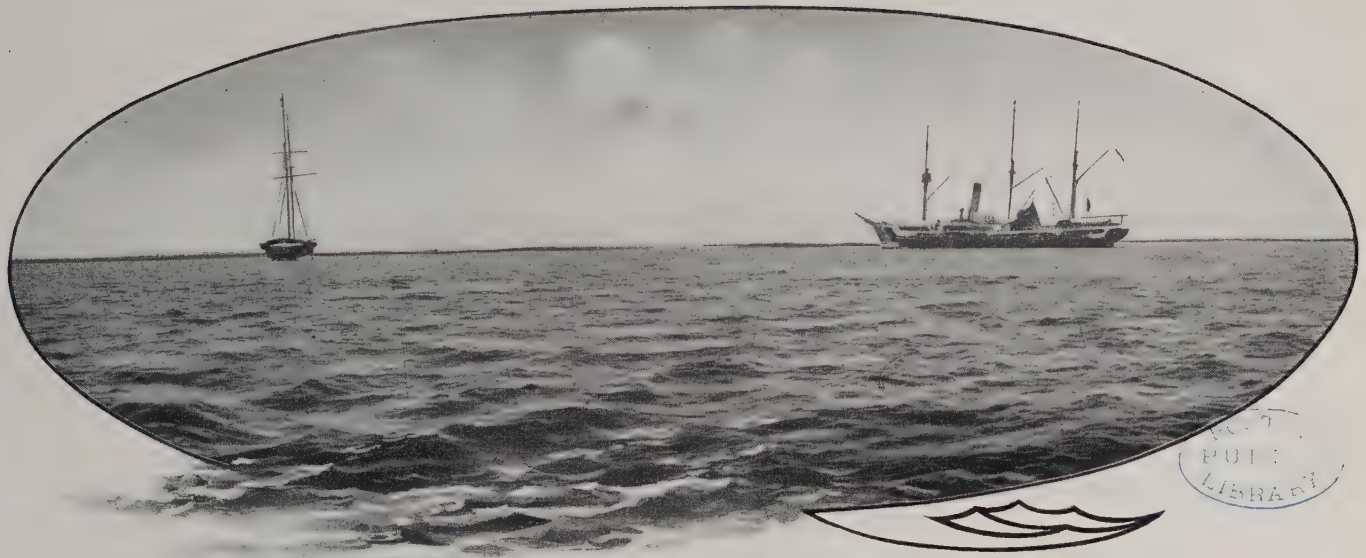
To perform these last duties, Major J. D. Moodie, of the Northwest Mounted Police, was appointed Acting Commissioner of the unorganized Northeastern Territories. Under his command were placed a non-commissioned officer and four constables of the Northwest Mounted Police, as a nucleus of the force that in the future would reside at these stations.

The *Neptune,* the largest and most powerful ship of the Newfoundland sealing fleet, was chartered as the most suitable vessel for the cruiser work. The *Neptune* is a stout wooden ship, built entirely of British oak, sheathed with 'iron-bark' and greenheart. Although built in 1873, she is quite sound

throughout, and of amazing strength. Her sides are formed of an outer sheathing of four inches of greenheart, on top of four inches of oak, covering heavy oak timbers, with an inside lining of three inches; the space between the inner and outer skins and the timbers is solidly filled with rock-salt, so that the sides of the ship are practically eighteen inches thick in all parts where a contact with the ice is expected. The bow is further reinforced by a heavy sheathing of iron plates, and inside it is backed with deadwood, giving it a thickness of eight feet. The *Neptune* is of 465 tons net register, and has engines of 110 nominal horse-power. This means that the ship will carry about 800 tons of coal and cargo, and that her engines will develop about 550 indicated horse-power; sufficient to drive the loaded ship at the rate of eight knots an hour. The engines, unlike most of the whaling and sealing ships, are placed amidships, while the vessel is rigged as a three-masted schooner, with low masts and little sail power.

Early in June, 1903, I had the honour to be appointed, by the Honourable Mr. Préfontaine, the Minister of Marine and Fisheries, to the command of the expedition to Hudson bay and northwards, on board the *Neptune*. I received instructions to proceed immediately to Halifax, to make necessary alterations to the ship, and to purchase all the provisions and outfit required for a two-years' voyage in the Arctics.

The ship—which only had accommodation for a small crew—was in the same state in which she had returned from the spring sealing voyage. After a thorough cleaning, carpenters and machinists were put aboard, and the work of alteration rushed day and night. A bridge-deck, covering the boiler and engine, was erected, with a small chart-house upon it. Alterations were made to the after cabin, and a new saloon and staterooms, for the use of the scientific staff, were made between-decks, forward of the main hatch. The remainder of



'Neptune' and 'Era,' Fullerton Harbour.

the between-decks forward was converted into storerooms and sleeping quarters for the petty officers and the Mounted Police detachment. The upper forecastle was fitted up for the crew and firemen. All the sleeping quarters were arranged so that a small air space separated the sides of the ship from the berths, and all ironwork was covered with wood. The value of these preparations was appreciated during the ensuing winter, when no frozen moisture was found in any part of the ship so treated, while elsewhere the bare sides had a thick coating of frost.

All these additions and alterations were made in a month's time, during which the stores and provisions were purchased and delivered on board, together with materials for the stations on shore.

The preparations being completed, the *Neptune* hauled out from the dock and anchored in the harbour on the evening of the 22nd of August.

THE CRUISE TO WINTER QUARTERS IN HUDSON BAY.

All hands were busy during the morning of the 23rd of August, in securing the heavy deck-load, consisting of lumber for the stations, which was piled high on the afterdeck, and on both sides of the bridge. Oil barrels and tins completely covered the quarterdeck, while potatoes and other vegetables were stowed in all corners, even the rigging having its load of fresh meat.

At noon the anchor was lifted, and we steamed out of the harbour of Halifax, not to return until the middle of October of the following year. A favouring breeze helped the ship along, and in the evening we were well on our way eastward along the southern coast of Nova Scotia. The following evening the eastern end of Cape Breton was passed, and we stood

northward to cross Cabot strait to Newfoundland. A strong breeze from the northwest sprang up in the night, when, owing to our heavy deck-load, the ship had to take shelter under St. Paul island, where we remained until the morning of the 26th. Fine weather favoured the passage across the gulf, and through the Strait of Belle Isle. Our first stop on the Labrador coast was made at Dominoe, where it was expected that a supply of codfish would be obtained. Unfortunately the season was very backward, and no dry fish had yet been made on the coast; a few pairs of sealskin boots were, however, obtained there. Continuing, with fine weather, northward along this grandly picturesque coast, Nachvak bay was reached on the 31st.

Our interpreter was supposed to reside here, but on reaching the small Hudson's Bay post, it was found that he was at Port Burwell, at the mouth of Hudson strait. More sealskin boots and a couple of barrels of trout were purchased from the agent; then, as our tanks were low, we steamed some ten miles to the head of the bay, to a small river of excellent water. The scenery about the bay is very grand; cliffs of 3,000 feet present their rugged barren faces on both sides, rising directly from the water and terminating skywards in lofty mountains with sharp peaks. Large patches of snow fill the upper valleys, where they accentuate the rocky desolation of the peaks.

Another clear, calm day brought us to Port Burwell, a few miles inside Cape Chidley, the northern point of the Atlantic coast, where the division line is drawn between the territory to the eastward, under the jurisdiction of Newfoundland, and that of the Dominion to the westward. Between Nachvak and the cape, the mountains of the coast reach their highest elevations, some of the peaks rising to upwards of 6,000 feet. The outline is extremely rough, the land rises abruptly from the coast and the scenery is very grand. As Cape Chidley is approached, the general elevation becomes lower; the land

Crew of the 'Neptune' in Winter Costume.

finally sinks into the sea with the Button islands, which form a group extending some miles beyond the cape. The heavy tides of Ungava bay exhaust themselves in the passages between the islands, and, in doing so, cause very dangerous currents. Gray strait, lying between the cape and the inner islands, would form an excellent ship canal, if it were not for these strong currents, which cause a dangerous sea when the tide is running against the wind, especially when the wind is eastward and the Atlantic swell heaves into the strait.

Port Burwell is an excellent harbour, sheltered from all but the southwest winds, and, even with these, distant capes break the force of the wind and sea. The harbour lies on the western side of Gray strait, and about fifteen miles from Cape Chidley. It was originally discovered by Commander Gordon, who erected one of the Observation Stations there in 1885. The surrounding country, although low in comparison with that to the southward, is rugged, with steep rocky cliffs, that rise from 100 to 500 feet above the water of the harbour. There is little level ground in the neighbourhood, and the trading post established there is situated on a small inside harbour, which cannot be seen from the anchorage. Trade is carried on with some dozen families of Eskimos living on the coast, and this is supplemented by the seals caught by the agent.

This is probably the most convenient and safest place for the establishment of a customs station for the regulation of the shipping trade, entering or leaving Hudson strait, and a small expenditure for lights would make it a safe port of entry at all times. The south side of the mouth of Hudson strait, during the season of ice, is much less embarrassed than the northern side; as a rule, Port Burwell is free of ice early and late in the season.

Some little trouble occurred in securing the services of Ford as interpreter, he being under employment at the station; but the matter was finally satisfactorily arranged with the agent.

PORT BURWELL TO CUMBERLAND GULF.

On the following day the voyage was continued northward from Port Burwell. A fog came on shortly after we left, and continued for three days, during which land was only sighted twice. When the fog partly lifted, on the evening of the 4th, we found ourselves close to the shore of Cumberland gulf, and about twenty miles east of Blacklead island. The ship anchored in one of the many bays of the high rugged islands that fringe the coast.

A landing was made near the anchorage, and a few hours spent in climbing over the steep, high hills of gneiss and granite, which rise from 500 to 1,000 feet above the sea, while the summits of the hills on the mainland behind often attain an elevation of 2,000 feet. Almost continuous inland navigation is afforded by the channels, behind the islands, lying along the entire southern coast of the gulf. The hills are very rugged, and show signs of glaciation, though much less marked than those on the hills of the Labrador coast. The higher valleys are filled with snow, but there are no real glaciers.

The weather cleared about noon next day, and towards evening the mission and whaling stations at Blacklead island were reached. A series of photographs of the place and of its natives was taken while Major Moodie was explaining the intentions of the Government to the missionaries and to the agent of the whaling establishment.

The settlement consists of a dozen small, one-storied, wooden buildings, comprising the house and storehouses of the whaling station, the church, hospital, dwelling house and outbuildings of the missionaries. All are located at the southeast end of the island, a few feet above tide water. The surface is rock, or very moist boulder clay, without drainage, and the refuse from the native encampment makes the surroundings very filthy. The water supply is obtained from small ponds,

HEAD OF NACHVAK BAY, LABRADOR.

in hollows of the rocks on the hill behind the houses. As the neighbourhood is overrun with dogs, and as the natives often build their snow houses directly over the ponds, the quality of the water is very bad, and probably accounts for much of the sickness prevalent here.

The mission is under the charge of the Rev. Mr. Peck, who for many years has devoted his life to the instruction and welfare of the Eskimo about Hudson bay, and, of late years, on Baffin island. He is ably assisted by two younger men, both of whom have had medical training. The headquarters of the mission are at Blacklead, from which place the missionaries travel, several times a year, to Kekerten, on the north side of the gulf, and to Cape Haven, on Cyrus Field bay, to the south. In this manner all the natives of the southeastern part of Baffin island are reached. The work of combating ancient superstitions has been hard and slow, but the results of the mission are beginning to tell, and the natives are now taking rapidly to the teaching and precept of the missionaries. The total number of Eskimos reached is about five hundred, and they are all connected with, and depend upon, the whaling stations of Blacklead, Kekerten and Cape Haven.

During the summer months all the able-bodied men, with some of the women and children, proceed to the head of the bays, and thence far inland, to hunt the barren-ground caribou, to secure a supply of skins for winter clothing and bedding. They are absent until September. On their return they are employed at the whale fishery until the gulf freezes fast, usually early in December. During the remainder of the winter, they maintain themselves by harpooning seal through breathing-holes in the solid ice, or by killing them in the open water, at the edge of the floe. Whaling is resumed in March and continues until the ice breaks up; then the seal hunt begins and ends only when the time arrives to go inland again.

The whaling operations are carried on in a similar manner at all of the stations. At each, there are one to three white men in charge, but the actual work is done by the natives. The whales are taken by harpooning them from boats cruising among the broken ice, at the edge of the solid floe. Each station has from four to six boats; consequently nearly every able-bodied native is employed in them during the whaling season. They and their families, at such times, are fed with biscuit, coffee and molasses from the supplies of the station, but supply their own animal food. The men are paid irregularly for their work, usually in tobacco, ammunition and clothing, and they receive extra pay when a whale is captured. Of course the pay alone does not at all represent the value of the whale, but the expense of the station, and the few whales killed prohibit a large expenditure. On the whole, the whalers may be taken as beneficial to the Eskimos, and now that the latter have long been dependent upon the whalers for guns, ammunition and other articles of civilization, there is no doubt that many would perish should the whaling stations be closed without other provision being made for the accustomed supplies.

Having obtained a pilot at Blacklead, we crossed, the next morning, to Kekerten, which is situated on one of a group of small islands forming a harbour a few miles from the mainland of the north side of the gulf. Owing to the rocks, cargo can only be landed here at high water; the harbour is open to the south, so that the anchorage is not safe during the continuation of winds from that quarter.

A three-masted Norwegian schooner was found at anchor, discharging supplies, and loading the oil, whalebone and skins taken during the past year. The captain of the schooner and Mr. Noble, the son of the owner of the station, from Aberdeen, boarded us shortly after arriving; from Mr. Noble we learned that two whales had been taken in Cumberland gulf during the

Port Burwell at Eastern Entrance to Hudson Strait.

past year. The oil and bone from these, together with the oil and pelts of 3,000 seals, and some bear, wolf, fox and walrus skins would realize a handsome profit, and lend encouragement to the continuation of the stations, which, for several years previous, had not cleared expenses.

Mr. Noble informed us that white whales are abundant at the head of the gulf during the summer, where they frequent the flat, muddy mouth of a river. They are driven by whale-boats up the river, on the rising tide, and kept there until the tide falls, when they become stranded upon the mud flats and are easily killed. This fishery has only been prosecuted in a desultory manner, and would probably pay if handled with judgment.

Two rivers on the north side, and one at the head of the gulf, are famous for their large Arctic trout, or salmon, which abound in the mouths of these streams during August. There is no doubt that a profitable fishery could be prosecuted in all these streams, as well as in many others along the coast to the northward and southward of Cumberland gulf, but as yet no attempt has been made to fish them for export.

The station at Kekerten consists of the usual half-dozen small buildings, all nicely painted, with the whaleboats ranged on skids, and barrels and tanks alongside clean and ready for use.

The same evening a return was made to Blacklead, where, taking on board Captain Jackson, the new master of Cape Haven station, and his boat's crew of natives, we left again, under a brilliant moon, for Cape Haven. The south shore of the gulf was closely followed, past innumerable bays and narrow channels formed by the islands and deeply indented shores of that side.

Cyrus Field bay was reached late the next afternoon, with a strong northwesterly breeze. As the approach to Cape Haven is

filled with dangerous shoals, it was thought unadvisable to attempt to enter it so late in the day, and the ship was headed up the bay, for a harbour known as Frenchman cove. We arrived at dusk, to find the narrow entrance blocked by a large iceberg, and the water too deep to anchor outside. A boat was sent off, and soon returned, reporting a narrow passage between the ice and rocks; with some danger this was passed, and the ship anchored safely in the small bay. Two small deserted houses perched on a narrow ledge of rock, close to the water, with a number of oil barrels in the rear, represent the remains of a former small trading station. The diminutive harbour is surrounded by sharply ragged hills of granite, whose summits are splotched with patches of snow; the valleys between are narrow and irregular, and are so thickly strewn with boulders and broken rock that nearly every trace of soil is hidden. The scant Arctic vegetation and the deserted houses enhance the desolation of the scene.

Having taken on board the casks of oil and a supply of fresh water, the ship was headed for Cape Haven, where a station, similar to those already described, was found on a snug harbour, behind a large island, near the end of the cape. This station belongs to Potter and Wrightington, of Boston, United States. For several years past it has been unlucky, and the few whales taken have paid neither the expenses of maintaining the station nor the cost of supplying it by a special vessel. Natives sufficient to man four whaleboats live about this station.

The general aspect of the country about Cyrus Field bay is somewhat similar to that of Cumberland gulf: high, rugged hills of gneiss and granite rise from 500 feet to 1,000 feet above the sea. The land on the northern side of the bay is lower, and the waters of this portion are broken by low islands and reefs, many of which become connected at low tide.

A long chain of islands separates this bay from Frobisher bay to the southward. These islands are all high and rocky;

Blacklead Island, Cumberland Gulf.

strong tides rush through the channels between them, and although several of the channels are reported to be safe for large ships, they are only used by the natives as short cuts to Frobisher bay.

Cape Haven was left late on the afternoon of the 8th, and Hall island, at the eastern extremity of the chain separating the bays, was passed in the early evening. The course was then laid across the mouth of Frobisher bay, to pass to the eastward of the great island of Resolution, lying on the north side of the entrance to Hudson strait.

Monumental and Lady Franklin islands lie some twenty miles off the mouth of Cyrus Field bay, and are about ten miles apart. A continuous string of large icebergs stretched in a line between the islands, and continued for some miles beyond them, both north and south. They showed that the islands were but the exposed portions of a long dangerous bank, upon which the bergs had grounded. A similar line of bergs was observed about ten miles inside and parallel to the outer line. As this is the only knowledge possessed of these reefs, ships crossing them should use caution, although, in most places, sufficient water will probably be found.

HUDSON STRAIT.

The bold, rocky shores of Resolution were passed during the night and early morning, and during the afternoon we steamed westward along the southern shores of Baffin island.

The channel between Resolution and Baffin islands is some miles wide, but is obstructed by a number of smaller islands. Very strong tides rush backwards and forwards through the channel, rendering dangerous an otherwise good passage.

The southern shore of Baffin island is indented with many bays, and no doubt when this coast is surveyed excellent harbours will be found along it. The land rises rapidly from the

coast, to an elevation of upwards of 2,500 feet; far inland is seen the glistening white surface of the great Grinnel glacier, which flows northward into Frobisher bay. Not being very active, it does not discharge icebergs.

The Saddle-back islands were passed in the evening; they number at least twenty, or double the number laid down on the chart. There are indications of good harbours between them. Soundings taken in the vicinity of the supposed Gripper shoal did not indicate any such obstruction to navigation. A large number of icebergs were passed during the day, having been apparently drifted into the strait by the westerly current of its north side, probably aided by favouring easterly winds. They were not very numerous to the westward of Big island.

The morning of the 10th the ship was off Douglas harbour, and, from there, coasted along the south side of the strait to Cape Weggs, whence a passage was taken for the east end of Charles island. The north side of that island was closely followed, in order to survey it.

Near the western end of the island many walrus were seen in the water and upon a small islet close to the shore. As several of these animals were required for dog-food during the coming winter, the ship was anchored in a small harbour near by, and early next morning the small launch was lowered ready for the chase. Soon after leaving the ship, several hundred walruses were seen sporting in the water about the islet. They were in bands, varying in numbers from ten to twenty, each band probably composed of an old male and his harem. A band would be singled out, and the launch, at full speed would put after it. When the animals became aware that they were being chased, they would endeavour to escape by diving, always keeping close together. At first they would remain under several minutes, and would travel four hundred yards; as the chase became hotter and hotter, the length of the dives gradually

PUBLIC LIBRARY

KEKERTEN HARBOUR, CUMBERLAND GULF.

decreased, so that, finally, the animals could hardly remain below the surface. The launch was forced among the tumbling mass of frightened creatures, and when directly over them, a man in the bow would select a large one, and drive a harpoon into it. The head of the harpoon was fastened by a few fathoms of line to an empty water keg, and as soon as the harpoon was fast the keg was thrown overboard. This harpooning is necessary, as the animals sink as soon as they are killed, and the buoyancy of the keg is required to keep them from being lost. When one had been harpooned, the launch was stopped, and the rest of the band continued to flee. Now comes the dangerous moment of the chase. The wounded walrus rises to the surface, and immediately attacks the launch, which it endeavours to capsize by fixing its tusk over the side. Quick shooting is the order, and even with a storm of bullets, many a monster has to be rapped over the head or pushed away with guns and spears. After this experience with the few first killed, it was found that by keeping the propeller in motion and the whistle blowing, they would not attack the launch, but would waste their energies in an endeavour to destroy the keg; consequently the danger of the sport was considerably lessened. Upwards of half a dozen shots, at close range, were necessary to kill each walrus. As soon as one was dispatched, it was towed to the ship, or to a convenient cove at the shore. Seven were captured during the day, and hoisted on board, where they completely filled the after deck. Owing to the difficulty of securing these large animals, at least twice that number, fatally wounded, were lost ; we later found this to be the usual proportion of killed to captured, where these animals are hunted for their skins and blubber, a waste of life altogether too great.

That evening the ship was headed for Cape Wolstenholme, and early next morning came to anchor in Erik cove, close to that headland. Advantage was taken of a fine convenient stream of fresh water to fill the nearly empty tanks. During

the day, two large white bears were killed by the hunters. The first was seen climbing along the steep cliffs fronting the harbour, the second being found in a deep hole that it had dug into a large snowbank, on the side of a high hill, and into which it had retired for a cool sleep.

Erik cove is an excellent harbour formed by a wide gully in the high hills of this part of the coast. The bay extends inland about two miles from the general coast-line; and good anchorage is found within a quarter of a mile of its head. On both sides, hills from 800 feet to 1,500 feet afford good protection against all but north winds. Unfortunately the bay is V-shaped, and quite open to the north, so that with strong winds from that direction it would be unsafe, and, during the season of ice, the danger would be considerably enhanced, as, owing to its shape, the ice would be liable to block, and to force a ship on shore without much chance of escape. A small river which flows down the continuation of the gorge winds from side to side of a low plain, which narrows as it extends backwards from the sea, up the valley. An excellent site for houses might be found on the plain near the mouth of the river.

HUDSON BAY.

Squalls of snow delayed us until the afternoon of the 13th, when we steamed westward along the north side of Digges islands. A bear was seen climbing over the cliffs, and a boat was lowered in chase, but the animal escaped. In the evening, the course was changed to northward, up Fox channel. At daylight the next morning ice was met with some ten miles from Leyson point. Steaming slowly through it, Seahorse point, on Southampton island, was reached at noon, and a landing was made with the launch. During the absence of the launch, the ship was sent out into the ice to the northeast, in order to

BOSTON
PUBLIC
LIBRARY

Walrus in Smith Sound.

examine its condition. It was found to be in large cakes of heavy rafted ice, too solid to penetrate at such a late date.

Seahorse point is at the junction of the granites and gneisses with the Silurian limestones. There is here a marked difference between the southern limestone area and the northern country, underlain by the crystalline rocks, with its typical long, low, rounded hills, lying in roughly parallel ridges, and separated by wide shallow valleys, dotted with lakes and ponds, or filled with coarse boulder clay, with boulders scattered in bewildering profusion everywhere. This land, although high by contrast with the limestone country, seldom reaches an elevation of 500 feet, and that only far inland. There is one conspicuous peak, which rises like a great sugar loaf, far inland, its snow-capped summit of the lightest blue.

The limestone country occupies all the southern part of this great island, and also underlies the large islands of Coats and Mansfield farther to the south. The same physical characteristics prevail wherever the limestone is found. The low shores are bounded by gradually deepening water, broken by dangerous reefs that extend several miles from the land. The country rises very slowly inland, from the shores, in a succession of low, broad terraces, each a few feet higher than the one in front. These terraces are covered to a depth of several feet by broken limestone, which affords perfect drainage, and in consequence the surface is so dry that it will not even support a covering of the hardy Arctic plants. This absence of vegetation leaves the monotonous light-yellow shingle quite unrelieved by any dash of other colour, and the general view is one of dry desolation, much worse than that of the hilly country. The limestone region never reaches an elevation of one hundred feet within walking distance of the shore.

The ship lay-to during the night, among scattered pans of ice, about five miles from the land, and in forty fathoms of

water. Late in the evening two walruses were killed on ice pans close to the ship.

A return to the southward was made at daylight, and the ice was finally left after passing Leyson point. During the passage through the ice, in the early morning, hundreds of walrus were seen asleep on the floating pans, and were left undisturbed. Skirting the low shores of the so-called Bell island, Evans strait was entered, and, late in the afternoon, we passed close to Walrus island in Fisher strait. This island is composed of crystalline rocks, and although not very high, it is conspicuous in contrast to the low shores on both sides of the strait. The island is much smaller than shown on the chart, and is only one island, not two, as marked there.

While passing through Evans and Fisher straits, soundings were taken every five miles. The bottom was found to be very even, and covered with fine sand or limestone debris. During the day the low shores of Southampton were in sight, without any feature sufficiently marked to afford a triangulation point.

The absence of ice in any part of Fisher strait led to the belief that no channel existed between Bell island and Southampton. This has since been confirmed by the captains of the *Era* and *Active,* both having narrowly escaped trouble in trying to pass through this supposed channel, which, if it does exist, is very shallow and narrow, even at high tide, and is so obstructed with shoals as to be absolutely dangerous.

During the night of the 15th we passed the western entrance of Fisher strait, and turned northward, up the west coast of Southampton. Frequent soundings, taken as the ship passed over, or very close to, the position of Tom island on the chart, gave no indications of it.

This island was placed on the chart, on the authority of Captain Lyon, but nobody has since seen it.

FULLERTON HARBOUR.

The 16th was thick and foggy, so that when the distance to Cape Fullerton had been run down in the evening, and the water had shoaled to twenty-five fathoms, the ship lay-to for the night. In the morning, standing to the westward, breakers were seen at nine o'clock; shortly after, several low islands were passed, and at noon the launch was sent ahead to sound the way into a long bay, which subsequently proved to be Winchester inlet. A good harbour, sheltered by islands, was found on the east side of the bay, and about three miles from its mouth, where the anchor was dropped at six o'clock in the evening.

The country surrounding Winchester inlet is very similar to that bounding the whole of the northwestern part of Hudson bay. The country is underlain by Archæan crystalline rocks, and has all the physical characteristics common to similar areas in the south. Long, gently rounded hills, of slight elevation, form the higher grounds, with wide, shallow valleys between them. The whole has been intensely glaciated, and the abrasion of the great ice-cap has reduced the general surface to as near a level surface as is possible, considering the varying resisting properties of the different rocks found here.

There is no soil upon the rocky hills, while that of the valleys is largely boulder clay, in which the coarser material predominates, leaving little room for the growth of Arctic vegetation upon the finer materials of the soil. Boulders scattered in profusion over the rocky hills give to the latter a peculiar ragged appearance. Lakes and ponds dot the valleys, and much of the land surrounding these is low and swampy.

The shores of the bay are low, and are masked, in most places, by a wide fringe of low rocky islands, while beyond the islands the danger zone is continued several miles seaward by a labyrinth of sunken reefs. The bottom of the bay, beyond these reefs, continues very uneven, so that in the portion between Winchester and Chesterfield inlets there is danger of a ship

grounding, when beyond the sight of the low shores. The proximity to the magnetic pole accounts for the sluggishness of the compass in these waters, where no reliance can be placed on it. This, with the uncharted, low coast, bare of prominent landmarks, renders the approach to any of the harbours uncertain and dangerous.

Inland from the shores the country rises slowly; indeed, the general elevation does not increase towards the interior above ten feet a mile, while along the shores there are no hills more than fifty feet high.

Our instructions were to find, and, if possible, to pass, the winter in company with the American whaling ship known to be in Hudson bay. The whalers formerly wintered at Marble island, or at Depot island; the former is to the southward of the mouth of Chesterfield inlet, the latter close to the entrance of Winchester inlet. Marble island has long been abandoned, chiefly on account of its insufficient water supply. Within the last few years a more convenient harbour was found close to Cape Fullerton, and the large launch was fitted out to search for it, the *Era* not being in the harbour at Depot island.

A strong gale lasted from the 18th to the 22nd, and we were very lucky to be in such a good harbour. While awaiting an abatement of the gale, several Eskimos came overland to the ship, and were taken aboard. They were from Cape Fullerton, and were going inland from Winchester inlet to kill barren-ground caribou for their winter clothing. They had seen the ship as she passed, but could not reach us with their whaleboats owing to the gale. We learned from them that the *Era* was already in winter quarters at Fullerton. This information rendered the proposed trip in the launch useless, and it was therefore determined to send her up Chesterfield inlet, as the only place where a sufficient supply of deerskins for our winter clothing could be procured from the natives. The services of

an old Eskimo, named Scotty, were secured as pilot for the launch, while another, Gilbert, consented to pilot the ship to Fullerton harbour.

The crew of the launch consisted of the second mate, third engineer, a fireman, sailor, the interpreter, Scotty and myself. We left the ship early on the morning of the 23rd, and the launch behaved admirably in the heavy head sea raised by the recent gale. A southerly course was followed, past Depot island, but the numerous shoals gradually forced us away from the mainland, so that the boat was ten miles from the mainland at the mouth of Chesterfield inlet, and even at that distance considerable difficulty was experienced in keeping clear of the shoals. They were eventually passed without mishap, and the course was changed to westward along the south side of Promise island, and then along that of the inlet, so that by dark we were fifty miles above its mouth. After steaming twenty miles farther, on the following morning the lower Eskimo settlement was reached, situated on a large bay on the north side of the inlet. All the men were absent hunting deer, and although there were many skins about the encampment, the women would not part with them without the permission of the men. The latter were not expected back until the next evening, so it was determined to continue on to the upper encampment, located thirty miles above the lower, on the southern channel, past Bowell island, where the inlet discharges from Baker lake. This encampment was reached early in the afternoon, and the absent hunters were signalled for with smoke. They arrived about two hours after us, and a lively barter was kept up until after dark, upwards of fifty skins and a considerable quantity of meat being purchased for powder, tobacco, knives and files. Four tents of Eskimos were at this place, which is a noted crossing of the deer in their annual migrations to the north and south. Great numbers had already been killed, and half-putrid heads were scattered in all directions about the tents.

Early next morning the launch was headed east, and, assisted by a strong tide, soon reached the lower encampment. The men were still absent, and did not return until the following morning, when we secured about as many skins and as much meat as at the upper camp. Leaving early in the afternoon, we continued down the inlet; at dark, the pilot became confused amongst the many islands off Dangerous point, and advised anchoring until daylight. An anchor watch was set, and the remainder of the crew went to sleep, to be awakened at midnight by the startling news that the launch was aground and the tide still falling. Efforts were immediately made to float her, but without avail. She soon fell over on her side, when the water rushed in, partly filling her. Some of the crew were then set to ferrying the cargo to a neighbouring island, while the rest bailed out the water and endeavoured to keep it out as the tide rose again, but without success, so the energies of all were devoted to saving everything possible. Many things were lost during the hurry and darkness, and daylight came to a cold and forlorn party stranded on a small island. Arrangements were made, during the morning, to erect the boat mast as a Spanish windlass, and with the assistance of the small boat to raise the launch upright with the next rising tide. Unfortunately the tide did not fall low enough to free the boat of water, or to permit a fair trial of our improvised tackle. The ponds of fresh water were already frozen over, and the weather was becoming cold and boisterous; not a day, therefore, could be lost in sending the twelve-foot dinghy to Fullerton for assistance. The energies of the party were now devoted to transferring the goods and cargo from the island to the mainland, about a mile distant, as it would not do to leave the party on an island without means of reaching the shores of the inlet. This work continued until dark, when, after a hurried meal, Wells, Ford and Scotty were sent off in the dinghy, with instructions to reach the *Neptune* as soon as possible; the remainder of the party, wrapped in their

Wreck Camp, Chesterfield Inlet.

blankets, laid down for a deserved rest. The following days were spent in drying and cleaning the skins and other articles saved from the wreck, and in hunting and fishing, neither of which was successful.

During these days the weather became cold, and several inches of snow fell, which added to the discomfort of our temporary shelter. Early on the afternoon of the 3rd of October the smoke of the *Neptune* was seen far down the inlet, and she came to anchor at dark in a harbour about ten miles to the east of the camp. Captain Comer, of the *Era*, in one of his whaleboats manned by natives was the first to arrive the next morning, and was followed later by three of the ship's boats. Ropes were fastened to the launch and boats, and as the tide rose the wreck was lifted from the bottom and buoyed into shoaler water alongside the island, where it was left until the next tide. Leaving sufficient men to continue the work, Captain Bartlett and the writer started in the whaleboat, double-manned, for the ship late in the afternoon. We had gone only a short distance when a heavy snowstorm came on. We continued rowing in this very thick weather until ten o'clock, when, within a couple of miles of the ship, we were obliged to stop owing to the intense darkness. We landed on a small island and made a partial shelter from the storm by placing the boat sail against a low cliff. The quarters were so small that all were obliged to stand, and so the night was passed. Next morning it took two hours to dig the sail from under the snow, after which we resumed our journey to the ship and only reached it by the help of a long line attached to a keg, paid out to us from the ship, which was reached at eleven o'clock, after an exciting and exhausting twenty-four hours.

The crew of the dinghy had made excellent time on their trip to Fullerton to seek relief. The first night they made only a few miles, being very tired and having a strong tide against

them. The next day the mouth of the inlet was reached; the night following they slept at Depot island. Next day with a fair wind and heavy sea they arrived close to Fullerton, and reached the ship the following morning. The *Neptune* started to our relief that afternoon, and anchored for the night off Depot island, Captain Comer, who had kindly volunteered, acting as pilot. The next day, when out of sight of land, on the north side of the entrance to Chesterfield inlet, the ship struck twice, and was in shallow water all the way to Promise island, after which the water of the inlet was found to be uniformly deep.

The gale in which we reached the ship continued for three days. On the evening of the 3rd of October the men with the boats returned to the ship, and reported having had a very rough time of it, in the makeshift camp there. On the 8th the ship steamed up the inlet and anchored close to the sunken launch. Efforts to bring her alongside the ship were immediately undertaken, and next morning she was successfully hoisted aboard. In the afternoon we started down the inlet, and anchored for the night a few miles above Promise island. On the 10th a heavy gale blew from the westward, accompanied by frequent, thick snow squalls. The anchor was raised at daylight on the morning following, when, keeping well to the southward of the shoals beyond the mouth of the inlet, we arrived safely at Fullerton at dusk that evening.

'Neptune' in Winter Quarters.

Southampton Island.

CHAPTER II.

WINTER QUARTERS AT FULLERTON.

The *Neptune* had safely arrived at Fullerton harbour on the 23rd September, and had dropped anchor close alongside the *Era*. Major Moodie, after looking over the ground, decided to erect a Police Post on the large island at the rear of the harbour. The lumber for the building was immediately landed, and before the ship left for Chesterfield inlet the frame of the dwelling had been erected and its sides partly boarded.

The harbour of Fullerton is formed by a number of small islands, situated on the east side at the mouth of a long bay,

and about five miles from Cape Fullerton, at the entrance to Roes Welcome. The harbour is quite small, with room for about three ships, and is fully protected by the islands and reefs surrounding it. The usual entrance is from the westward, where the channel is not above fifty yards wide, and the water at high tide is only five fathoms deep. The eastern entrance is narrower, and a ship is obliged to make several sharp turns when passing through it. Owing to the low even coast, without any landmark in the vicinity, the position of the harbour is difficult to locate without entering the wide danger-zone of shoals. The wide fringe of islands to the westward practically ends at Fullerton, so that a ship making the coast may know the position by the presence or absence of islands; but as the islands are very low it is hard to distinguish them from the mainland at a safe distance away, as the shoals and reefs extend more than five miles beyond the harbour. The surveys made in the spring of 1904 show that a fairly safe channel will be found by keeping well to the eastward of the harbour, and by then following a northwest course, keeping in line the beacons on a small island about a mile outside the harbour. When the Beacon island is reached the ship should pass in mid-channel between it and the adjoining island to the westward; passing these, the outer harbour island should be given a wide berth, until the entrance to the harbour is opened fully, a long shoal extending from the western point of the island

On the return of the *Neptune* to Fullerton, immediate preparations were made for the coming winter. The first undertaking was the cutting of a large quantity of ice, from a fresh-water pond close to the house and about a mile distant from the ship. The ice was about nine inches thick, and one day's work, by the entire crew, sufficed to cut and to store enough to supply the ship with fresh water until the ponds melted again in the spring. The detachment of Mounted Police, assisted by some of the crew of the *Era,* were busily engaged

in finishing their house and shed. Floating ice soon hampered landing operations. On the 17th October the ice in the harbour set fast and, soon after, the work of transporting materials to and from the shore was done with sleds.

By the end of the month, the ship had been placed in a north-and-south position, so that her bow faced north into the prevailing cold winds. The decks were covered with a temporary roof, made from a part of the lumber intended for the police buildings. This housing kept the snow from the decks, and greatly increased the inclosed space on the ship. It later proved so comfortable that the carpenter worked in it, almost without interruption, throughout the winter, at the repairs to the launch. The house and shed were made weather-proof, and a supply of provisions and outfit, sufficient to keep the ship's company until the following summer, was stored in them, as a precaution against the destruction of the ship by fire. The galley was moved from the deck to between-decks, and the range connected with two large copper tanks, in which the daily supply of ice was melted; at the same time all the provisions likely to be injured by frost were stored alongside the range. All the oil and powder were stored on an island away from the provisions, and the boats placed either on shore, or on the ice alongside the ship.

Shortly after our arrival the natives congregated about the ships, and to avoid misunderstanding, an agreement was made with Captain Comer, that he should care for the Aivillik tribe, while the Kenipitu tribe would belong to the *Neptune*. By this arrangement, about a dozen able-bodied men and their families fell to our portion, and about double that number to the *Era*. The men were employed, during our stay at Fullerton, in banking the ship with snow, hauling ice and other necessary outside work. Several of them hunted continuously, and at small cost kept the ship in fresh caribou meat throughout the winter.

They received little pay beyond their food, which consisted chiefly of the scraps left from the meals.

Dr. Faribault had shown signs of mild insanity, almost from the time of leaving Halifax. On the 1st of November he became violently insane, when, on the advice of Dr. Borden, he was placed in charge of the police as a dangerous lunatic. The poor man had to be confined in a cell, and watched continuously. His condition became worse and worse, until he was happily released by death on the 27th of April following.

As soon as the ice became sufficiently thick to bear the load, a wall of snow about three feet thick was erected around the ship, and raised to the top of the temporary decking. Sails, spread on the roof, were covered with about a foot of snow. By these means all draughts were effectually kept out of the ship, and the temperature of the interior was raised several degrees. Holes were cut in the banking to allow light to enter the ports and windows, and snow porches were erected over the exits on each side; the deep holes at the ports resembled embrasures, and the general appearance of the ship was that of a floating fort.

When the labour for preparing for the winter was finished, the ordinary work about the ship was hardly enough to keep the crew in health, and all were encouraged to hunt or attend lines of fox-traps for exercise. This proved much better than formal exercise at stated times, and the general health remained good throughout this long period of enforced idleness.

Only two meals were cooked daily during the short days of mid-winter, breakfast being at ten and dinner at four, an informal supper being provided in the evening.

Games and cards were provided for the use of all; musical instruments, including a piano, were in frequent use, while a weekly lecture, dance and newspaper went far to agreeably pass away the long winter evenings, which were further relieved

Snowhouses on Ice, near the 'Neptune.'

by visits between the ships, and to the snowhouses of the natives built on the ice close alongside.

On the night of the 11th of December a second sad occurrence happened. When everybody was busy preparing letters for the mail about to be sent to Churchill by a couple of Eskimos from Baker lake, James O'Connel, a cabin-boy of weak mind, left the ship to go to the snowhouses, and wandered away in a snowstorm, which commenced shortly after his departure. He had been in the habit of hiding behind the launch, or in other places about the decks, where he would remain for hours, and, in consequence, his absence was unnoticed by his mess mates until the following morning. Immediately upon the alarm being given, the crews of both ships and all the natives turned out and searched systematically, in all directions from the ship, but, owing to the blizzard, without success. The storm continued to rage during the next two days, so that it was only on the 15th that definite information concerning his fate was obtained by the natives, who traced his track in the snow to the open water in the southwest some three miles from the ship, where the poor fellow had gone before the strong wind. There is no doubt that death came quickly, and we were relieved of the thoughts of his possible sufferings had he continued to wander about the country and finally died of exhaustion and cold.

The short days of mid-winter and the excessive cold of the early spring practically rendered impossible any surveying or other outside scientific work until the month of April, when preparations were made for exploratory and surveying work. During the winter Mr. Crossman made a very efficient ice-boring machine, which worked admirably in making holes for sounding through the thick ice. Weather observations were taken five times daily during our stay at Fullerton, and these, together with the readings taken on the voyage, are printed in

Appendix No. I., where also will be found a summary of the climatic conditions, prepared from the observations by Mr. Stupart, Superintendent of the Canadian Meteorological Service. A list giving the thickness, week by week, of the ice in the harbour, will also be found in that appendix, and is interesting as showing to what a late date the ice continues to increase, the maximum thickness of seventy-four inches having been obtained on the 25th April.

SPRING EXPLORATIONS.

On the 11th April Mr. Caldwell left the ship, accompanied by five natives, with instructions to explore the coast northward to Wager inlet; and if the conditions of weather, food and dog-food would permit, to continue his work to Repulse bay, returning before the ice along the coast broke up. His outfit and provisions were carried upon two dog sleds, one of which was to return after helping him over the rough ice of the shore of Roes Welcome. He succeeded in the exploration of Wager inlet, but, owing to the delays caused by bad weather, was unable to reach Repulse bay. Mr. Caldwell on his trip did a large amount of excellent work in surveying the coast-line and examining the rocks met with along the route.

At the same time Mr. King was engaged, when the weather permitted, in making an accurate plan of Fullerton harbour, the channel of approach and the environments within a radius of thirty miles of the ship. Several hundred soundings were made with the aid of the boring machine, the soundings being under the charge of Mr. Ross. As a result an accurate chart of the harbour and channel has been prepared for the use of the ships calling there.

Owing to the serious illness of Dr. Faribault, whose death was expected daily, and to other causes, I could not leave the ship on any long trips at this time, and my out-door work was

Hauling the Winter Water Supply.

confined to the superintendence of the surveys, and to such geological work as could be accomplished within a day's journey of the ship.

On the 4th of May, accompanied by two Eskimos, I left for an exploratory trip along the coast to the mouth of Chesterfield inlet, in order to connect the work of Caldwell with that of Tyrrell. This work was accomplished in ten days, during part of which we were confined to our tent, and almost buried by the heaviest snowstorm of the year. A sketch survey was carried to the mouth of the inlet, and all rock exposures on the way were examined. The rocks met with were chiefly granite, with masses of dark schists inclosed in the granite areas. Some of the schists were cut by quartz veins, which carried small quantities of pyrite, but nowhere sufficiently concentrated to be of value. The most promising locality seen was on the islands a few miles to the westward of Fullerton, where the veins were numerous, and where the natives report some veins well mineralized.

On the return journey the country about Winchester inlet was examined inland for a distance of forty miles. A description of its physical character has already been given.

Mr. Caldwell arrived back safely on the 30th of May. The first rain fell on the 21st, after which the weather gradually lost its wintry character, and although by no means warm, was sufficiently moderate to allow the surveying work to go on without much discomfort.

From the first week in June all hands were busy removing the winter coverings, and getting the ship in order for the coming summer.

WHALEBOAT TRIP TO SOUTHAMPTON ISLAND.

Captain Comer had kindly invited me to accompany his boats on a whaling trip to Southampton island, and for this purpose had lent me two boats fitted with covers for the trip.

Accompanied by Dr. Borden, two seamen and six Eskimos, we left the ship on the morning of the 15th June, being transported to Cape Fullerton over the shore-ice by dog-teams to where the boats were found hauled out on the ice close to its edge. The morning was quite cold and boisterous, and not at all pleasant for a boat cruise. Our boats and the four belonging to the *Era* were soon loaded and launched. A fair wind allowed us to sail northward through a narrow lead of open water between the shore-ice and the moving pack, which completely covered the sea outside. Early in the afternoon we reached the other boats, manned by natives, hauled out on the ice and covered in for cooking operations. A cup of hot coffee soon reduced the chill received in the boats. The journey was then resumed, but in a short time the ice closed in on the shore, obliging us to haul our boats on to the solid ice, where they were propped upright, and soon roofed with cotton covers stretched over light wooden frames. This turned each boat into commodious and comfortable sleeping quarters, and soon the evening meal was being cooked over the oil stoves. The ice remained tight on the coast, and it was only with great difficulty that the boats were forced through it a few miles to Whale point, where we remained hemmed in the next day.

At Whale point a small house was erected some years ago as a station by one of the American whalers. It is situated on the summit of the point, and a ladder leads to the roof, where a small platform served as a lookout station for whales swimming in the ice-laden waters of Roes Welcome. This is a favourite camping ground for the Aivillik natives in the early summer, whales, seals and walrus being then plentiful in the adjoining waters, and the barren-ground caribou numerous within a short distance of the coast.

According to Captain Comer, more whales have been killed within sight of Whale point than in all the rest of Hudson bay; on this account, and from the ease with which it might be

Mr. Caldwell Starting North.

supplied, it would probably prove an excellent place for a post from which to control the whale fishery. The water supply, obtained from small pools in the rocks, is rather bad, owing to the number of dogs and natives about.

Two days were occupied in crossing from Whale point to Southampton island, and as Roes Welcome was full of floating ice, several exciting moments were experienced when the ice came together with each change of tide, threatening to crush the boats if not quickly hauled out on a convenient heavy pan. The monotony was also broken by the capture of a bear and several large seals. We remained in company with the whalers for two days after reaching the island, and coasted southward to Cape Kendall without seeing any sign of a whale. As our work was chiefly on land, we then determined to part company, they continuing southward while we made inland excursions. The ice was still fast to the shore, from which it extended seaward from two to six miles. The boats were of necessity at the edge of the ice, and the long tramp through deep slush and water to and from the shore was fatiguing and cold. Only the ridges on the land were free of snow, which was still deep in all the hollows. The weather was now sufficiently warm to keep the snow soft and wet, and to make a passage from one ridge to another necessitated wading waist deep through the snow. Under these conditions extensive journeys inland were impossible, and we were confined to the shores of the island. Good collections of fossils from the limestones of the island were obtained, and a large number of bird skins and eggs were collected. It was unfortunately too early in the season for plants.

The western shores of Southampton are low. The land behind rises in a succession of ridges each a few feet higher than the one immediately in front. These ridges are formed of broken limestone, evidently the surface portion of underlying ledges. Very little vegetation grows on the ridges, but in the wide depressions between them there is a profusion of grasses

and other Arctic plants on the wet ground surrounding the many ponds and lakes found there. The shores and islands of these lakes are the breeding grounds of a number of rare birds, among which may be mentioned Sabine's Gull, Arctic Tern, Whistling Swan, Hutchen's Goose, Snow Goose, Jager, Little Blue Crane and Red Phalarope.

The water is usually very shallow for two or three miles from the land, and reefs of limestone extend much farther out. About Cape Kendall dangerous reefs are found at least eight miles from the land.

We remained on the island a week, gradually working northward, until we were about ten miles to the north of our original landing place, or some forty miles beyond Cape Kendall. Advantage was taken of a fine evening to re-cross Roes Welcome, and we started at midnight in broad daylight. Shortly after leaving, a large whale came to the surface close to the boats and remained in the vicinity for upwards of thirty minutes. The crossing was safely made during the day, the only incident being the meeting in mid-channel of an extensive mass of very heavy ice, some of its pinnacles being upwards of thirty feet above the water; the natives said it was a large floe from Fox channel. We were obliged to sail several miles to the northward in order to pass this floe, and so reached the mainland a few miles south of the mouth of Wager inlet, and a like distance from Yellow bluff, where the Aivilliks spend the late summer. Nothing of note occurred on the passage down the coast, and the ship was again reached on the 2nd of July.

Little change was apparent in the condition of the ice since our departure, and the solid floe, extending a couple of miles beyond the harbour, gave little hope of the ship being released by the approaching high tides. The ship was now ready to leave as soon as the ice would permit, but this did not happen until the 18th, a marvellous change taking place daily in the condition of the ice for a week previous to that date.

American Whaleboats in Roes Welcome.

PUBLIC LIBRARY

A Greenland Iceberg.

CHAPTER III.

Summer Cruise of the Neptune in 1904.

HUDSON BAY.

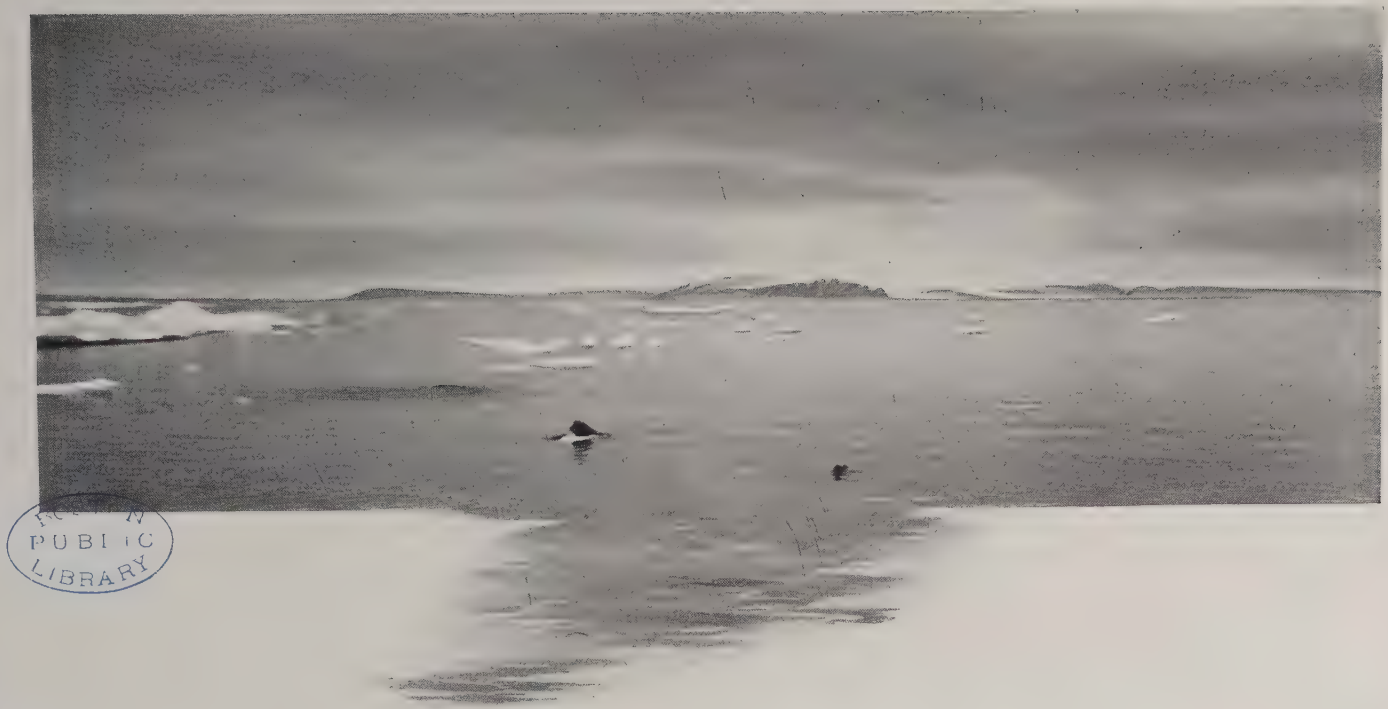
The anchor was hoisted and the moorings to the ice cast off at two o'clock on the morning of the 18th of July, when the *Neptune* proceeded to break her way out of Fullerton harbour, after having been nine months there fast frozen in the ice. Little difficulty was experienced in breaking the harbour ice, when, following a pilot boat, the narrow eastern entrance was soon passed and the ship was once more free. Loose stringers of small ice extended a few miles from the shore, after which only occasional lumps were seen during the day, as the ship

steamed across to Cape Kendall, and then followed the west coast of Southampton southward. The southwest point of the island was passed before midnight. This point lies well to the northward of its position on the chart, or in about 63° N. latitude.

The low southern shore of Southampton was followed during the night, and only a few stringers of ice were met with. At four o'clock in the morning the island was lost to sight, and by noon we were steaming along the equally low shores of Coats island, with the small but prominent Walrus island in sight to the northward. Ice to the northward gradually forced the ship closer to the shores of Coats, where, after passing a wide bay, partly filled with large, low islands, we coasted within two miles of a prominent headland about four hundred feet high, which forms the northeast cape of Coats, and which was named Cape Préfontaine in honour of the Honourable the Minister of Marine and Fisheries. These highlands appear to traverse the island diagonally in a southwest direction, coming out at a lower altitude on the south side of the island several miles west of Cape Pembroke. This ridge is due to a band of crystalline rocks, which rises from beneath the low flat limestones forming the remainder of the island. A large whale was seen while passing through Fisher strait.

Beyond Cape Préfontaine the ice became more plentiful, and many large pans were met with. The ice had the appearance of being lately broken up, and owing to its smooth unrafted condition we judged it came from Fisher strait, rather than from Fox channel to the northward. During the night this ice forced the ship southward into the channel between Coats and Mansfield, so that the western shore of the latter was reached some twenty-five miles to the south of its northern end.

Open leads in the ice were found from three to five miles from that island, and no difficulty was experienced in gaining



PUBLIC LIBRARY

Midnight in Smith Sound.

its north end. This island of limestone is somewhat higher than Coats and Southampton, rising inland in low broad terraces to an elevation of upwards of a hundred feet. Small patches of snow were seen under banks and along the faces of the terraces, but elsewhere the green colour showed that considerable vegetation covered the greater part of its surface.

Similar lanes of water, between large cakes of ice, afforded an easy passage from Mansfield to Digges islands. A great amount of ice was seen to the southward, apparently completely filling the channel between Mansfield and the mainland. To the northward some open water occurred, but the patches became smaller and smaller as Digges was approached, and finally ceased to the eastward of these islands, the southern part of the western end of Hudson strait being completely filled with ice.

A strong southerly wind had been blowing all day, and it was hoped that it had loosened the ice along the southern shore of the strait. The ship was taken under the land, but without success, so that after butting through the slowly closing ice all night, we were finally tightly beset in the early morning, about three miles from the eastern Digges island. The 21st was foggy, with snow flurries in the morning and showers in the afternoon; the ice remained tight about the ship all day, and she drifted eastward with the ice, passing Cape Wolstenholme, and in the evening being about five miles to the east of Erik cove. At that time considerable open water could be seen about five miles from the ship to the eastward, with a few narrow lanes in the rear, and other small openings to the northward, where the dark sky showed considerable open water beyond our view.

HUDSON STRAIT.

Persistent ramming forced the ship through about five miles of ice on the morning of the 22nd, when she was again tightly

beset until the evening, at that time being about twenty-five miles to the eastward of Cape Wolstenholme, this distance having been made by the drift of the ice. The ice slackened again at eight o'clock in the evening, when after an hour's heavy work we got into a lead of open water under the land, and continued at full speed all night, steaming east in a lane from two to four miles wide.

At five o'clock next morning we were off Deception bay and the western end of Charles island. The bold coast along which we had been passing all night now became less abrupt, and this change was accompanied by shallower water in the sea fronting it, so that when seven miles from the mouth of the bay, soundings taken at the edge of the ice only gave twelve fathoms, with indications of an uneven bottom, where it would be dangerous to be caught in the ice if the wind should change and force it upon the land. The ship was turned into the ice, and in an hour had reached a place of safety. In the afternoon, with clearing weather, the ice opened, and not much difficulty was experienced in forcing between the loose pans, first towards the east end of Charles island and later more easterly, so that when the ice again closed we were about ten miles northeast of Cape Weggs.

During the night and following morning we continued to drift rapidly to the eastward. Before noon we were opposite the mouth of Douglas harbour, having made fully twenty miles of drift during that interval.

The ice began to slacken at ten o'clock, when we got under way, and forcing the ship towards the north at noon we were in open water, with a heavy northerly swell, which showed an open sea in that direction. Only a few small icebergs and broken pans of ice were seen during the remainder of the trip to Port Burwell, which we reached on the evening of the 25th, but in crossing Ungava bay the lower temperature and an ice-glint to

the southward indicated some ice in the southern part of that bay.

The following summary of the condition and extent of the ice met with on the passage from Fullerton to Port Burwell may prove of interest and value. The northwestern part of Hudson bay was quite free of ice, and none to obstruct navigation was found in Fisher and Evans straits. Large quantities of ice were encountered between the mouth of Evans strait and Digges at the western end of Hudson strait, but without serious trouble safe passages were found through it, and there is no doubt that an ordinary unprotected iron steamship would have passed through it at that time without trouble or danger. This ice, evidently the product of the past winter, consisted chiefly, as has been mentioned, of large flat sheets that had only a short time previously broken from their original position, for there were no signs that it had been subjected to pressure or to the action of a swell. The edges of these large cakes had not been crushed, and many soft thin spots were seen which would disappear with the slightest pressure or swell. Along with the predominating flat ice was a considerable amount of rafted ice of the same character, and also of portions apparently subjected to pressure during the past winter. All the ice was comparatively light and thin, which led to the belief that it had come out of Fisher strait, and from the southward up the channel between Mansfield and the eastern mainland, the meeting of these streams producing the blockade at the western end of Hudson strait. Owing to its thinness and rotten character, the greater part of this ice would melt a few days after we passed it.

The ice in the western part of Hudson strait was somewhat heavier than that described above. Much of it was rafted ice in small cakes, and there was a small number of ancient, heavy, discoloured pans that had evidently come from Fox channel.

This ice completely filled the side of the strait, and probably extended to Nottingham island, but there was open water on the north side of the strait through which the whaler *Active* had already passed on her way into Hudson bay. The important point to be noted is that during all the times that the *Neptune* was beset by the ice during the passage east along the south side of the strait, there was never any sign of the surrounding ice rafting by the pressure occasioned at the change of tides, and never was the pressure about the ship sufficient to cause damage to an unprotected iron ship.

There is little doubt that if a more northerly course had been taken on the passage eastward much more open water would have been found, including an unobstructed passage from at least the western end of Charles island, while to the westward open lanes would probably have extended from the neighbourhood of Nottingham island.

During the early part of July ships proceeding out of Hudson bay will probably find on the southern side of Hudson strait, or rather on the southern side of the mid-channel, the best and safest passage, owing to the easterly currents of that side. Ships entering Hudson bay at this time should follow the northern side of the strait, keeping as far as possible away from the land, especially that of Big island, until that island is passed, when the mid-channel should be held past Nottingham island, and from there the course should be laid to pass within easy distance of the north end of Mansfield island. The strong tides in the eastern part of the strait, and especially about Big island, cause the ice to close with considerable pressure at the change of tide, and this dangerous pressure is most severe close to the land.

We arrived at Port Burwell on the date arranged before leaving Halifax for meeting the relief ship. By a coincidence the *Erik,* bringing our supply of coal and fresh provisions,

Ice off Cape Wolstenholme.

arrived in port only an hour ahead of the *Neptune*. The ships were soon moored alongside, and the mail from civilization was distributed to the ship's company, this being the first news of the outside world received in eleven months.

VOYAGE TO THE ARCTIC ISLANDS.

A week was spent at Port Burwell, transferring the coals and provisions from the *Erik* to the *Neptune*, and in landing a large quantity of coal and provisions for the use of the North-west Mounted Police. All this work having been finished, both ships weighed anchor early on the morning of the 2nd of August, the *Erik* bound south for Newfoundland and the *Neptune* northward for Smith sound.

Major Moodie having decided to return to Ottawa, left on the *Erik*, and that ship also carried our second steward, who was invalided home, along with a sailor of the *Era* who, during the past winter, had nearly died of scurvy.

The course was laid across the mouth of the strait, and at noon the snow-covered cliffs of Cape Resolution bore north-northeast, distant about twenty miles. A few icebergs were passed during the afternoon, but no field ice was seen until the following evening, when a few heavy pans were met. As the weather was thick with fog the ship slowed down for the night, and the course was changed more to the eastward. Thick fog continued until the afternoon of the 6th, when, the weather clearing, we found ourselves about twenty miles to the westward of the great island of Disko, on the coast of Greenland. The scenery of the island is very grand; the shore-line is deeply indented by narrow bays, from which the land rises abruptly into irregular mountain masses, terminating in sharp peaks, whose loftier summits were hidden in the straight line of clouds formed from the recently risen fog. All the higher valleys were filled with great glaciers pouring slowly down into a sea

dotted with numerous fantastic icebergs. The contrast between the dark sombre rocks of the hills and the dazzling whiteness of the glaciers was enhanced by the streams of sunlight which flooded the interior, while the coast was veiled by the fog clouds.

The weather remained clear throughout the night and next day, as we passed northward along the rugged coast of Greenland, catching many views of its great ice-cap behind the numerous high islands that fringe the coast. The greater part of the surface of these islands was free from snow; glaciers were only seen in the higher valleys. The ice in the long fiords and the channels had broken up and been carried away, so that only numerous icebergs were seen along the shores. In the afternoon considerable heavy field ice was passed on the west. Our noon observation placed us about twenty miles off the Danish settlement of Upernivik, to the northward of which the sea was filled with great icebergs, they being especially numerous in the neighbourhood of the Devils Thumb island, so named on account of the prominent peak bearing some resemblance to that member.

When the Duck islands had been reached the ship's course was changed to westward to cross the dreaded Melville bay. This great bay owes its bad name to the quantities of heavy ice infesting its waters during the early summer, and the whalers count themselves lucky if the delay does not exceed three weeks.

We steamed directly across for Cape York, ahead of a strong gale of wind accompanied by heavy rain and sleet, and saw no ice until within a short distance of the cape, where broken floes and icebergs formed a fringe extending a mile or so from the land. Continuing westward close along the outer margin of the ice we were abreast of Cape York at three in the afternoon, having made a record passage across the bay.

The weather becoming very thick, we shortly after stood inside the outer stringers of ice, and kept close to the ironbound

Parker Snow Bay, North Greenland.

coast in order to sight Conical island, and so reach the fine harbour of Parker Snow bay just inside the island; this was successfully accomplished, and the ship was brought to anchor near the head of the bay. The wind freshened during the night, and in the morning blew so strongly that it was impossible to reach the shore with the ship's boat. At noon the wind registered forty-eight miles an hour, and some of the gusts were much stronger.

The wind fell towards evening, allowing us to land. We were now well north of the Arctic circle, and a bright sun remained visible all night.

An ascent of one of the glaciers at the head of the bay afforded valuable information concerning the ice-cap and glacial phenomena, discussed later in the report. A sharp rocky hill, 960 feet high, divides the glaciers; this was crossed and the descent made by the second glacier, where much trouble was experienced crossing the deep gullies cut into it by surface streams of water. Neither of these glaciers discharges into the sea, their fronts terminating against high steep banks of boulder clay brought from above by the moving ice. A light pink gneiss, cut by many veins of quartz apparently all quite barren, is the chief rock of these hills. The hills surrounding Parker Snow bay rise in abrupt cliffs nearly 1,500 feet above the water; the country then rises less abruptly another thousand feet to the lower level of the great ice-cap which covers the entire interior of Greenland.

SMITH SOUND.

On our return to the ship the anchor was raised and we left the bay, passing the great Petiwik glacier at midnight, with the sun shining over the top of its five-mile front of ice, which ends in abrupt low cliffs of ice rising directly from the sea. Large icebergs are frequently broken from this long face, and

hundreds of them are seen aground on ledges for miles on both sides of the glacier.

The westward course was followed a few miles farther, after which the ship turned north through the fine channel between Cape Atholl and Wolstenholm island. A small amount of loose ice was met with in the channel and in the crossing to Saunders island. The crystalline rocks which occupy the coast from Cape York give place here and to the northward to almost horizontal beds of sandstones and lighter coloured rock, probably limestone. Large masses of dark trap are associated with these bedded rocks, either as sills injected along the bedding, or as dikes approaching more or less closely to the vertical.

Cape Parry was passed at eight o'clock on the morning of the 10th, when, crossing the mouth of Whale sound, we followed the channel between Northumberland and Herbert islands, having a fine view of their high cliffs of sandstone and light-coloured rock, which rise almost perpendicularly from 500 to 1,000 feet above the sea. Similar cliffs occupy the coast of the mainland from the north side of Inglefield gulf to the neighbourhood of Etah, at the narrowest part of Smith sound. The day was very fine, and only a few loose pans of floe ice and many icebergs embarrassed the course followed by the ship.

The upper portions of Whale sound, Inglefield gulf and McCormick bay were filled with ice, which from a distance appeared to be still unbroken from the shores. During the day walrus were frequently seen in groups upon the floating pans of ice, where many large seals lay basking in the sun. The walrus were most numerous on the ice between Cape Alexander and Etah, where attempts were made to photograph the larger groups, but without success, as it was late in the evening and the animals were unusually wild.

As the coast is followed northward the cliffs and the mainland behind become lower, so that about Cape Alexander the

A Glacier of Bylot Island.

general level of the front of the ice-cap does not appear to be greatly over 1,000 feet in elevation.

On the trip northward the ship passed close to several of the places where the Eskimo usually reside during the summer months, but no signs of them were seen as far north as the Littleton islands, whence we crossed to Cape Sabine, after making a call into the harbour of Etah, famous as the most northern human habitation on the earth, being 78° 30′ N. latitude. At Etah we saw a number of deserted underground houses, where the natives live during the winter, and a small quantity of coal left by Peary, who used this place as headquarters during one of his attempts to reach the pole.

Our voyage northward was stopped by heavy sheets of Arctic ice coming down Smith sound in the vicinity of the Littleton islands. Into this neighbourhood it would be dangerous and foolish to force the ship for no definite purpose. A crossing was therefore made to Cape Sabine, and considerable anxiety for the ship's safety was felt passing between the great pans of thick solid ice, some of which were miles in extent, and rose from three to six feet above the water, with pinnacles of much greater height. Some very hard knocks were given to the ship as she was forced through the heavy ice from one lead of water to the next, and everybody felt relieved when the little harbour at Cape Sabine was reached in safety.

A landing was made here, and a visit paid to the last winter quarters of Peary, which are situated near the eastern end of the cape on the side of Payer harbour, formed by a few small islands lying a short distance from the cape. The harbour being full of ice, the ship could not enter it, but stood off under steam, it being dangerous to anchor with the large sheets of heavy ice passing southward on the tide. The landing was made about a mile from the house, which was reached by climbing over the granite cliffs of the shore, at two o'clock on a

delightfully calm, clear morning, with the sun well above the horizon.

The station consists of two small houses, that belonging to Peary being the old deck-house of his ship the *Windward,* the other, a small building with single-boarded sides, in which the Stein expedition spent two winters. The houses were only a few yards apart, both about fifty yards from the water, and surrounded with the usual heaps of old tin cans and empty boxes found about northern quarters where the staples of food are carried in cases. A large amount of putrid walrus blubber was scattered everywhere about the place, and the smell from it was far stronger than that of a deserted snowhouse in spring-time, which was our previous limit to pungent and disagreeable odours. On a low rocky hill, a few yards behind the houses, were the burial-mounds of five Eskimos, four adults and one child, all wrapped in musk-ox skins and loosely covered with stones. An old gun, snow knives and other gear belonging to the dead were placed alongside the graves. These must have been very pleasant company during the long Arctic night, especially so close to the scene of the Greely disaster, where many of that party died of starvation and sickness before relief could reach them.

When one has been at the headquarters of these Arctic expeditions, a good idea is gained of the difficulties and privations of those engaging in polar research. Peary was here, over eight hundred miles in a straight line from the pole, forced to make many trips to transport his provisions and outfit to the farthest land before he could attempt his dash across the rough Arctic pack for the pole. The pluck and daring of such men are to be admired, but the waste of energy, life and money in a useless and probably unsuccessful attempt to reach the pole can only be deplored, as no additional scientific knowledge is likely to be gained by this achievement.

Cape Herschel, Ellesmere Island.

On our return to the boat, we found that a very large floe had come between us and the ship, and in doing so a corner of it had caught on a small island and had gone completely over it, showing the momentum of these great cakes, and the hopelessness of the attempt to build a ship sufficiently strong to withstand the pressure exerted by such ice moving on the tide when suddenly arrested by land or by motionless ice. A narrow lane of water still showed between the floe and the land, and by hard rowing we got safely through before it closed, when the ship butted the way through other ice and finally took us on board.

Ross bay was now crossed in order that a record might be left at Cape Herschel on the mainland of the great island of Ellesmere, Cape Sabine being on an island separated from the mainland by a narrow strait. When about a mile from Cape Herschel, going full speed, and while an attempt was made to pass between two small icebergs, the ship struck heavily on a sharp point of rock. Luckily she did not hang, but bounced over it, striking again amidships and finally on the stern post. A sounding taken within two hundred yards of the rock gave a depth of seventy fathoms, from which it was concluded that the rock was a sharp submerged peak, with the icebergs grounded on two sides of it. The pumps were immediately sounded, but the ship was found to be making very little water, and the full extent of the damage was not known until the vessel was placed in dry-dock at Halifax, when it was found that the blow in the bow had loosened the iron stemplate, which was subsequently lost in butting the heavy ice, and the lower stem was carried away to the ends of the planking. Luckily the *Neptune* is eight feet thick in the bow, and could stand a great deal of damage there without serious danger to her floating qualities. Seventy-five feet of the keel was removed by the second blow and the stern-post twisted and broken by the third.

It took little time to attend to the duties of the landing at Cape Herschel, where a document taking formal possession in the name of King Edward VII., for the Dominion, was read, and the Canadian flag was raised and saluted. A copy of the document was placed in a large cairn built of rock on the end of the cape.

The return to the ship was made at half past six in the morning, when, steaming southward, the heavy dangerous ice from Smith sound was soon left behind. We continued southward all day, passing as close to the land as the ice would allow, so as to make a chart of this badly surveyed coast. The survey was carried to a point about fifteen miles to the south of Cape Isabella, where the weather became foggy, and progress through the ice was only possible by following leads of open water running southeast or diagonally away from the coast.

The ice met with during the crossing of Smith sound and for a few miles southward of Cape Sabine was chiefly large masses of thick Arctic ice, lately brought south by the northern current from Kennedy channel, where the fast ice appeared to have broken loose only a short time previous to our arrival, and was quickly emptying out of the great channel leading direct to the Arctic sea. All of this ice was solid, and from twenty to forty feet in thickness, and could not be of the previous winter's formation as no ice of that thickness can be formed in one season. The greater part of it probably had been formed on the surface of the Arctic ocean, during one or more years' drift across the polar regions before it entered the northern part of Kennedy channel, where it had remained during the past winter, and was now passing south to mingle with the other ice of the 'middle pack' of Baffin bay. Much of the ice met with to the southward was composed of large sheets of similar heavy Arctic ice cemented together by thinner ice of one season's formation, evidently drifted out of some bay to the southward

of Cape Sabine. It had quite recently broken away in great sheets (one of which took three-quarters of an hour to steam past) from the mouths of the bays whose inner surfaces were still tightly frozen as we passed them. The diverse character of these large sheets is further increased by the number of small icebergs often seen frozen into the mass along with the polar sea ice.

The eastern side of Ellesmere island is quite high, the probable general elevation exceeding 2,000 feet and perhaps 3,000 feet. The coast-line is broken by many deep bays and prominent headlands. The land rises precipitously from the frozen sea into irregular mountains, whose partly rounded peaks are as a rule masked by an ice-cap which appears to be continuous along this eastern coastal region, although it is said not to continue for any great distance inland. Great glaciers fill all the valleys and actively discharge icebergs into the bays. Only the projecting rocky headlands and some of the lower points facing south in the bays are free of snow and ice, so that at least nine-tenths of the surface is permanently covered by an icy mantle. This is in marked contrast to the Greenland coast opposite, where all the outer cliffs and the shores are comparatively free from snow and ice. The cause of this marked difference of climate is probably due to a divergence of direction of currents along these coasts. On the Greenland side a southerly current, comparatively free of ice, allows the open sea to raise the general temperature, while on the Ellesmere side the Arctic current, with its continuous stream of ice, blocks the bays and does not allow the open water to ameliorate the cold of the ice-covered lands. The prevailing easterly winds also carry more moisture to the west side, causing it to be masked by fog at the time of brilliant sunshine on the opposite coast.

The 12th proved thick and dirty, with much rain. Land was only seen in the early morning, and not again until five o'clock

in the evening, when a number of small islands showed our position to be off Cape Horsburg, the northeastern point of Philpot island, on the northern side of the entrance to Lancaster sound: we had therefore passed across the mouth of Jones sound without a sight of the land on either side.

LANCASTER SOUND.

Short glimpses of the land on the north side of Lancaster sound were obtained when the fog lifted at intervals during the night. These showed a high country, with many moderately sharp peaks rising in the foreground above the white mantle of ice of the great glaciers of the valleys. Discharging glaciers were particularly numerous along the head of the wide Croker bay.

At eight o'clock in the morning we arrived at the mouth of Cuming creek, a long narrow bay a few miles west of Croker bay. Being short of fresh water, and the weather promising to be bad, we proceeded ten miles up the bay before finding a place sufficiently shallow to drop anchor, but this was finally done on the edge of a bank formed by the material brought down by a small river flowing into the head of the bay. We remained at anchor here until the next evening, the wind during that time blowing strongly from the eastward, accompanied with thick fog and occasional flurries of snow.

The crystalline rocks, which occupy the eastern part of the great island of North Devon, are overlaid by nearly flat-bedded limestones, in the western part commencing on the west side of Croker bay. This change of rock is accompanied by a change in the physical character of the coast as the ragged irregular granite hills of the eastern land are replaced by a flat tableland which rises in nearly perpendicular cliffs directly from the sea to elevations varying from 800 to 1,200 feet. Behind these the land rises in steps to nearly 2,000 feet, where it is lost beneath

the ice-cap of the interior. The cliffs of limestone have been deeply sculptured by all the streams of water, great and small, so that the coast resembles on a gigantic scale the banks of a stream flowing through a clay country. This portion of the coast extending to Beechey island at the southwest point of North Devon, is deeply indented with many long narrow bays similar to Cuming creek, in which we were anchored. While there, landings were made to collect plants and fossils, and an attempt was made to reach the tableland, but proved unsuccessful owing to the impossibility of scaling the perpendicular cliff near the summit. The land about the bay was particularly desolate and barren, the little vegetation found being along the courses of the small streams. No trace of land animals was seen. Walruses and seals were observed sporting in the waters of the bay, and a large colony of Burgomaster gulls pointed to the presence of fish.

The anchor was lifted at eight o'clock on the evening of the 14th, and two hours later we were steaming westward close under the cliffs in order to make a survey of the coast. This was completed to Beechey island by eleven o'clock next morning, when the ship again came to anchor.

The cliffs to the westward of Cuming creek gradually become lower, and the crystalline rocks below the limestones soon disappear beneath the sea. A few small glaciers discharge into the sea in the neighbourhood of that place, but as the coast is followed westward the ice-cap retreats inland, and is finally lost sight of, nothing being left to break the monotony of the dirty yellow colour of the limestone except a few patches of struggling vegetation that increase towards the westward where the climate is evidently milder.

As many of the crew as could be spared were allowed to land at Beechey island to visit this historic spot, where the ill-fated and heroic Franklin and the crews of the *Erebus* and *Terror*

spent their last winter on land, and where the headquarters of the search party was established in subsequent years.

Beechey island is comparatively small, being only a square mile or so in extent. It lies at the southwest end of North Devon, and is connected at low tide by a narrow neck with the larger island, thus forming the good anchorage of Erebus harbour. The southern side of the island is a small hill, from three to four hundred feet high, with steep cliffs facing the water and less abrupt slopes northward, where it falls to the level of the low plain of the rest of the island. A flagstaff crowns the summit of the hill. The lower part of the island rises from the waters of the harbour in a succession of three or four low terraces each a few feet above the one in front, and all covered with small loose limestone shingle, where a few hardy flowers struggle for existence on the dry barren surface.

The ancient settlement was placed on the edge of the plain, close to the foot of the hill, and facing eastward. On the shore are the ice-battered remains of a small sloop, now completely dismantled, and a large mahogany lifeboat badly broken by the ice. On the first terrace, a few yards above the high-water mark, stands the frame of the ancient house, with a low stone wall along its north and west sides. Inside and between the walls are many casks of provisions, all of which have been broken open and the contents spoiled. A small platform cart, showing few signs of its long exposure to the weather, stood beside the house, and was brought home as a souvenir. Scattered in profusion over the terrace and along the shore were the empty tins of the notorious Goldner's Patent, which had been opened, found rotten and condemned by Franklin, thus reducing his stock of supposed tinned provisions. Old cask staves and hoops were mingled with hundreds of leather boot soles, evidently left by some of the relief expeditions.

On the next terrace, a few yards in rear of the house, a

Franklin Monument at Beechey Island.

wooden cenotaph surmounted by a round ball and set in a small platform of cemented limestone was erected to the memory of Franklin and his heroic associates by one of the subsequent expeditions, and to-day stands in a fair state of repair. Resting face-downward on the platform, alongside of the cenotaph, was a large marble slab, inscribed, as a tribute to the memory of Franklin and the crews of the *Erebus* and *Terror,* by citizens of the United States. A brass plate, affixed to the lower part of the slab, records that it had been brought from Disko to its present resting place by McClintock in the *Fox,* when he obtained final proof of the total destruction of Franklin's ill-fated party. The slab was raised and photographed, and then replaced on the ground to avoid the danger of its being broken by the winds. If another expedition visits this place the material for a suitable foundation for the slab should be taken, so that it may be erected as originally intended.

On the barren plain, a few hundred yards from the house, are four graves marked by small wooden crosses, the last resting place of two of Franklin's crews and two belonging to the search parties.

A sealed tin case was found attached to the cenotaph, and on opening it a record of the Norwegian Magnetic Pole Expedition was found. The record stated that the *Gjoa,* with the expedition on board, had arrived here in the latter part of August, 1903, after having picked up the provisions left for them at Dalrymple island by one of the Scotch whalers, and were proceeding immediately down Peel sound in order to get their ship as near as possible to the magnetic pole before the sound became frozen over. As this was the last tidings from this expedition the record was taken away, and since our return has been forwarded to the Norwegian government. The *Gjoa* in which the expedition sailed is a small but stout sloop, with auxiliary power supplied by a gasolene engine. The only

danger to the party is in event of the *Gjoa* being unable to free herself from the ice when the time comes for a return. As the expedition is aware of the whaling and police establishments in the northwestern part of Hudson bay a retreat there may be made without great difficulty, if accompanied by natives.

We were forced to leave Beechey island hurriedly, owing to a large quantity of ice being driven rapidly out of the harbour by a fresh breeze and a falling tide, which threatened to separate us from the ship.

From the island no ice could be seen to the westward or northward in Wellington channel and Barrow strait. Our instructions limited the cruise westward in Lancaster sound to our present position, and the damaged condition of the ship, together with a supply of provisions insufficient for another winter in the ice, all militated against the desire to attempt the Northwest Passage, which under favourable conditions seemed possible in our staunch powerful steamship.

We left Erebus harbour at half-past two in the afternoon, standing southward across Lancaster sound for North Somerset island. At five o'clock some loose stringers of ice were met, and the course was changed to the eastward to avoid them. The north wind freshened to a gale accompanied by fog, and trouble was experienced in making the channel between Leopold island and Cape Clarence, at the mouth of Prince Regent inlet. The cape was passed at ten o'clock. The ship then steamed south, along the high cliffs of limestone, for Port Leopold, where we arrived at midnight. These cliffs rise 1,000 feet perpendicularly, being formed of nearly horizontal beds of limestone of different thicknesses and various shades of yellow, so that the cliff has a marked horizontal banding. The rocks appear to have long been submitted to the action of the weather and of small streams, each of which has cut a more or less marked gully into the face of the cliff, and the whole, taken together, give the

PROVISIONS LEFT FOR THE 'GJOA' AT PORT LEOPOLD.

appearance of vertical fluting, while the weathered tops have a castellated finish like that of some gigantic fortress. The cliffs fall away abruptly into a long low point of shingle which partly closes the mouth of the spacious and safe harbour of Port Leopold.

As we steamed into the harbour what appeared to be an overturned boat with a wooden 'lean-to' built against it was seen at the end of the low point, with a small Danish flag flying. The whistle was blown, but no sign of life appeared about the place, and thinking that the Magnetic Pole expedition might perhaps have met with some disaster and that the survivors might be in want, a boat was lowered and the doctor was sent ashore with stimulants and warm blankets. Happily his services were not required; the supposed boat proved to be the boiler of a steam launch, left here by one of the Franklin search parties. Against it were piled a number of cases of provisions left a few days previously by the whaler *Windward* for the *Gjoa*, and marked by a small flag flying above them.

The light-coloured limestone forms the bottom of the harbour, and gives the water a dangerous looking, light tinge, which is quite misleading, as the depth is sufficient for the largest ships. The east and west sides of the harbour are bounded by high cliffs, while at the northern end the land is low, and it is not far across it to the bay on the northern coast lying directly west of Cape Clarence.

North Somerset has physical characteristics closely resembling those of North Devon; the limestone cliffs of the northern shore, however, appear to be somewhat lower and more broken than those of the northern island, while the amount of snow and ice of the land is considerably less. The high perpendicular cliffs of the east side appear to continue far to the southward down Prince Regent inlet.

The wind increased during the night, and blew a gale all next day, strong and almost continuous gusts from the high hills sweeping the crests from the waves and rendering a landing impossible. The wind fell away towards morning. On the 17th a landing was made on the point, the flag was hoisted and a copy of the Proclamation and of the Customs Regulations was left in the boiler. Close alongside lay the wreck of the launch, destroyed by the ice, only the keel, some of the timbers and lower planking remaining. Signs of the whalers and of natives were plentiful on the point, where the circles of stones and fireplaces marked the tents of the former, and other fireplaces showed where the whalers had been 'trying-out' whale blubber. A curious sled-runner of teak was picked up on the beach. It was about six feet long and full of holes bored for lashing on the shoeing, which was of walrus ivory, and further secured to the runner by wooden pegs. The wood was either from the wreck of the launch, or more likely from that of the *Fury,* lost early in last century, some miles to the southward of Port Leopold, on the western side of Prince Regent inlet. The evidence of great age in the runner points to the latter origin.

Port Leopold was left shortly before noon, and we were soon tossing in the head sea caused by the past gale. The wind changed to eastward, and within an hour of leaving the harbour we were again inclosed in a thick fog, which rendered a return impossible. The fog lasted until the next evening. During the interval we steamed cautiously across the mouth of Prince Regent, Admiralty and Navy Board inlets, and with clearing weather found ourselves outside the Wollaston islands that lie a few miles from the northwest corner of Bylot island. A parting between the lower and upper fog gave a beautiful ribbon-like picture of the rough snow-covered coast and peaks of Bylot island flooded with bright sunshine, in marked contrast to the gloomy, foggy weather about the ship.

A wide belt of heavy field ice, which was dangerous to enter in the low fog that obscured the shores, lay along the land; consequently the impressions of the northern part of the island were obtained from a distant view between the banks of fog. The scenery was characteristic of the northern lands occupied by the crystalline rocks, the principal feature being sharp rugged peaks upwards of 1,500 feet in height, rising above the deep glaciers of the valleys and backed by a continuous ice-cap a few miles inland.

PONDS INLET.

During the night much field-ice and many icebergs were passed as we steamed along the shores. Next morning at eleven o'clock, having rounded Cape Graham Moore, we came to an Eskimo encampment just inside Button point on the north side of the entrance to Ponds inlet. A landing was made at the mouth of a small stream, on the clay banks of which were located thirteen cotton and skin tents of these natives. All the able-bodied men were away in the whaleboats, either at Erik harbour, on the south side of the inlet, or some distance up it. There were a large number of women and children who, with a few sick men, completely filled a whaleboat in which they visited the ship in search of food. Many were sick with a disease resembling typhoid-pneumonia, being troubled by internal bleeding and a high fever.

We secured the services of a very intelligent man as pilot to the place some miles up the inlet where the Scotch whalers were anchored. From him we learned that the sloop *Albert* had wintered in Erik harbour, and that two small whales had been captured by natives in her boats during the early summer. Continuing our way up the inlet, a second encampment of six tents was passed about six miles beyond Button point. From the pilot we learned that the total native population about Ponds

inlet comprised thirty-five families, or one hundred and forty-four persons. The only other band on the northern shores of Baffin island lived at Admiralty inlet, and does not exceed forty persons in all. Members of this band annually visit Ponds inlet to trade for the necessary supplies of ammunition, knives and other articles to be obtained from the whalers. At this time over one-half of the population of Ponds inlet were away inland to the southwest after a supply of deerskins for winter clothing, and would not return before the snow fell. The deer country is free from snow during the summer, and consists partly of rolling country, with a few high hills, but principally of a plain, cut by many streams and dotted with numerous lakes, the deer feeding on the grass and shrubs which are plentiful in the interior.

Bylot island is everywhere high and rough, and supports few deer except in the northeastern interior. The ice-cap, seen everywhere from the coast, does not extend far inland, where much of the land is bare in summer. The natives of Ponds inlet frequently cross to Fox channel and Repulse bay. During the past winter a party returning from the latter place brought letters from the whaling station at Repulse bay. They also occasionally cross to North Somerset, where of late years musk-oxen have been killed. This journey is at rare intervals continued across Lancaster sound to North Devon, where many deer and musk-oxen are found along the western side, while bears and walrus are plentiful among the ice of Wellington channel. In the winter all congregate at Button point, where the early part of the season is spent in houses built half into the ground, the low walls being made of boulders and whalebones cemented together with clay and sods, the roof being a portion of the summer tent. The ordinary snowhouse is used, as in other places, after the snow falls and until the late spring. During the winter food is obtained by killing narwhals and occasional seals and walrus in the open water at the edge of the

Cliffs of Bylot Island.

solid ice near the mouth of the inlet. The whales come in July and sport about the mouth of the inlet until the ice breaks up, when they either follow the solid edge in its retreat up the inlet, or pass southward along the coast. In former years at least half of the whales taken by the Scotch whaling fleet were captured in the vicinity of Ponds inlet.

Owing to the northwest trend of the south shore the inlet gradually narrows as it is ascended, so that about fifteen miles above Button point, where a high rocky island terminates the southern point, the distance from shore to shore does not greatly exceed three miles. Farther westward it again broadens to twice that distance, and so continues until, turning north, it bounds the western side of Bylot island, where it is known as Navy Board inlet. Two long narrow bays pierce deep into the comparatively flat country of northern Baffin island from the neighbourhood of the bend, and a very fine salmon river empties into the more eastern bay. At the time of our visit the western end of the inlet was still filled with ice, making it impossible to visit this portion.

About ten miles beyond the narrows we came to anchor close under the steep clay banks of the drift plain on the south side of the inlet, and alongside the Scotch whalers *Eclipse* and *Diana*. Shortly after, we were visited by Captain Milne, Captain Adams and Mr. Much of the *Albert*.

A great deal of valuable information concerning whales and whaling, as well as about the ice currents and other points relating to the Arctics, was obtained from these gentlemen, all of whom have had many years' experience in these regions. Much of this information has been used in the article on whaling, which is printed later in this report.

Finding that Arctic salmon were plentiful at the mouth of the little river about a mile from the ships, a small net was borrowed, and two boats were sent away to secure a supply of

fresh fish. They returned loaded in an hour, having made but four casts of the net, in which over a thousand splendid fish were taken, varying in weight from three to ten pounds and aggregating at least 5,000 pounds.

A strong gale from the eastward blew until the evening of the 21st, with thick banks of fog covering the hills and filling the narrows, while the weather about the ships remained fine and clear. The *Diana* broke adrift during the gale and lost an anchor and thirty fathoms of chain. During our detention landings were made, and some trips were taken inland over the high, terraced plain, which extends far to the south and westward. The lowest terrace is two hundred feet above the sea. The surface of the plain is uneven, and deeply cut by the valleys of several small streams. The higher terraces flank the rocky hills to the eastward, the highest being fully six hundred feet above sea-level. On the plain and in the valleys there is considerable Arctic vegetation, from which a very interesting collection of plants was made by Dr. Borden.

A number of partly underground houses, similar to those already described, were found at the mouth of a small stream close to the anchorage. From several ancient graves along the banks of the stream a short distance from the houses a good collection of skulls was obtained.

When the gale abated, we started down the inlet for Erik harbour, accompanied by the other ships; the narrows once passed, we had to literally feel our way to the harbour through the dense fog, and anchored at its head alongside the whalers *Balaena* and *Albert*.

A landing was made to collect specimens of the granites and their associated rocks, which form the hills surrounding the harbour, and to visit the glacier which fills over two-thirds of its head. The glacier is a mile wide where it empties into the harbour, the ice along the front being about a hundred feet

Eskimo Encampment at Ponds Inlet.

thick. As there is now very little motion to the ice, few icebergs break off, and those that do are too small to cause danger to the vessels in the anchorage. The southern corner of the bay is free of ice, and a small river discharges there from a southern valley. The glacier comes down the northwest valley, leaving its rocky wall about a mile inland ; thence to the sea it is bounded by a steep ridge of glacial drift full of large boulders; the crest of this ridge gradually falls from two hundred feet to fifty feet as it approaches the water. There are large quantities of mud on and through the ice, so that all the streams discharging from it are very dirty. At some former time this glacier filled the entire valley extending to its mouth five miles away, and depositing against the rocky walls banks of boulder drift to a height of four hundred feet above the present level of the sea. There is no doubt that in the glacial period the size and extent of the glaciers of Baffin island were much greater than at present; at the same time the sharp outlines of the hills, together with the absence of that intense polishing and striation of the rocks so common in Labrador and more southern regions, point to a much thinner ice-cap during the glacial period in these northern regions than on the continental area to the south. This may be accounted for, in part, by a smaller precipitation from the narrow, ice-laden seas in the north.

VOYAGE SOUTHWARD FROM PONDS INLET.

We left Erik harbour late on the afternoon of the 22nd, intending to proceed southward along the coast in order to correct the chart, which we were informed was very unreliable to Cumberland gulf. The fog closed down shortly after leaving, and, soon, large sheets of heavy ice forced us to the eastward away from the land, which was not seen again until we were within a few miles of the northern side of Cumberland gulf, on the morning of the 27th. Meanwhile the ship, continuously

battling with heavy floes of northern ice, had been forced nearly over to the Greenland coast in the endeavour to find a passage southward, and then had to work back to the western side in order to visit Cumberland gulf. Continuing in this heavy ice, which completely filled the gulf, we finally reached Blacklead island on the 31st, having passed a small Norwegian brigantine tightly beset in the ice about twenty miles from that place. We lay alongside this vessel during the night previous, and were boarded by her captain, who rightly had much fear for the safety of his small unprotected craft in the heavy pack. All the supplies for the coming year belonging to the mission and whaling stations of the gulf were aboard, and if she were crushed everybody living at those stations would have a hard time until relief reached them in the summer of 1905. We took on board the mail and ship's papers for the stations, and left her still tight in the ice.

At Blacklead we were visited by the Rev. Mr. J. Peck and the agent of the whaling station, and learned from them that the past year had been very unprofitable to the whalers and disastrous to the natives. Owing to the quantity of broken ice that had been tightly jammed into the gulf throughout the summer, and which prevented the boats from reaching the open water, no whales had been captured, though a few had been seen. A succession of heavy easterly gales occurred during the winter, causing a heavy swell, which from time to time broke up the solid ice of the bay and prevented the natives from going as usual to the edge of the open water on their winter chase after seals and walrus; many, consequently, were in a chronic state of starvation during the winter. The same cause prevented relief reaching them from the stations, dog-travelling being impossible. Late in the autumn a heavy gale, in conjunction with an extra high tide, swept away several tents and other belongings of the natives who were camped on the lower part of the island, the tide rising twenty feet above the ordinary

high-water mark. In March the heavy swell broke up ice three feet thick, on which forty Eskimos were encamped. During their retreat to a place of safety three of these people perished from exposure or were drowned, while many more suffered from frost-bite and exposure. All the survivors escaped with their lives only, losing all their belongings on the ice.

The total returns from the two stations on Cumberland gulf comprise about three thousand sealskins, twenty tons seal oil, two walrus skins, one bearskin and a few white-fox skins. The value of the whole is less than the cost of the provisions consumed.

A large amount of valuable information concerning the Eskimo living on the eastern part of Baffin island was obtained from the Rev. Mr. Peck. It has been used in the preparation of the article on the Eskimos.

A number of interesting photographs, some of which are reproduced in this report, were taken on the following day, when a trip was made to the summit of the island. From that point the northwestern part of the gulf could be seen blocked with ice as far as and far beyond Kekerten. The brigantine had drifted westward with the ice and now lay becalmed in it, about twelve miles to the northward, with much ice between her and Blacklead. No special object could be gained by a trip to Kekerten, and we therefore started, outward bound, early on the afternoon of the 1st of September. Heavy ice was encountered all the way to Cape Haven, which was reached on the morning of the 3rd. The ship was stopped at the small islands about four miles from the station, owing to the danger of entering the harbour with so much heavy ice drifting about on the strong tides. A boat load of natives came off to the ship about an hour after our arrival, and reported that Captain Jackson had left with two boats about ten days before on his way to Blacklead in search of supplies, all the provisions at the station being ex-

hausted, and no new supply having come for the present year. No whales had been captured, and the year's hunt comprised a few bear and walrus skins. The same complaints were made of the ice and easterly gales as at Blacklead, and the prospects of the station looked very dark. The natives said that a letter for us had been left at the station. A boat was sent for it, but returned with the information that it was addressed to the captain of the vessel supposed to be bringing supplies to the station from Boston.

The heavy Arctic ice, through which the *Neptune* had been constantly battling for the past two weeks, was finally left a few miles south of Cape Haven, greatly to the relief of everybody.

According to the Scotch whaling captains and the people at the stations, this season was the worst ever known as regards ice on the coast of Baffin island, and fog and constant southeasterly gales. The last mentioned account for the prevalence of ice.

Passing across the mouths of Cyrus Field and Frobisher bays, and to the eastward of Resolution island, Port Burwell was again safely reached on the 4th. We remained in the harbour three days, taking on board coal and provisions previously landed for the Mounted Police.

PORT BURWELL TO FULLERTON AND BACK.

Having crossed the mouth of Ungava bay, a strong headwind greatly delaying the ship, we put into Wakeham bay on the south side of the strait, to test its capabilities as a harbour. A fine clear passage was found into the bay on a line from the east end of Prince of Wales island to the centre of the inlet; there are a few low shoals on both sides of this line, but all are well beyond the course. A high, rounded point connected by a sandy neck to the south side of the bay forms an excellent protected anchorage just inside the heads. A second anchorage was found

Women's Boat at Wakeham Bay.

about five miles farther up on the same side, opposite to an Eskimo encampment and close to a good stream of water. Anchoring at the lower place, we were visited in the evening by a number of natives from the encampment. Several books, given for distribution by the Rev. Mr. Peck, were handed out to them, and they immediately held on deck a service of song and prayer. These natives had never seen a missionary, but had learned to read from others at Fort Chimo who had come in contact with the missionaries on the east coast of Hudson bay.

A pilot, well acquainted with the southern coast of the strait as far as Cape Wolstenholme, agreed to accompany us to Fullerton and return again on the ship.

We started early in the morning of the 8th, and passed through King George sound, reaching Douglas harbour at eight o'clock, where we were boarded by two natives, each in his kyak, one of which contained a bear lately killed. A number of walrus were seen about the small islands a few miles east of Douglas harbour. Continuing close to the coast, shallow water was encountered while passing inside of Joy island, a few miles east of Cape Weggs, where suspiciously low islands fringe the shore. After considerable difficulty had been experienced in extricating the ship from this dangerous position, deeper water was followed to the cape, when the course was laid for Charles island. While steaming along the island next morning a ship was seen passing out of the strait, but too far away to signal. She afterwards proved to be the *Strom,* belonging to the French Fur Company.

The walrus, so plentiful last year about the western end of the island, were now absent; consequently we were unable to obtain a supply of dog-food for Fullerton. The course was next directed southward for Deception bay, in the mainland, opposite the western end of Charles island. When within a few miles of its mouth the water became shallow and the bottom uneven, so

that the bay could only be approached with safety by sending the launch ahead to sound. It was thought that too much precious time would be lost in this undertaking, especially as it was known that a good harbour existed in the bay, where the whaler *Arctic* had twice anchored, so we passed westward close to the land in order to correct the survey made during the night on the trip eastward. About thirty miles west of Deception bay the mouth of another long narrow inlet, known as Sugluk bay, was entered, and the ship continued five miles up it looking for a convenient place for water. A shallow place was crossed at the mouth of the bay, probably due to the ship being too close to the eastern shore, but, inside, the water was found to be very deep, and an anchorage could only be obtained on the edge of the narrow mud banks close under the rocky cliffs of both shores.

In the small launch, the survey of the bay was continued to its head, some five miles beyond, where the ship anchored. At the head of the bay three families of natives were found, living in a state of destitution. This was their first direct contact with white men; they were somewhat shy and frightened, but a present of tobacco and biscuit soon made all good friends. These people do not visit any of the far away trading posts, but trade their furs with their neighbours on the east or west for guns and other articles of civilization.

Considerable difficulty was experienced returning against a very strong tide, and the ship was not reached until long after dark.

The following afternoon the remainder of the south coast was surveyed to Cape Wolstenholme, where we arrived at dark; then the ship was headed north across the strait for Salisbury island, the eastern end of which was reached early next morning. Following close along the steep rocky shores of the northern side, the northeast point was reached at noon. The

weather throughout the morning had been bad, a strong northwest breeze bringing down frequent heavy blinding showers of snow. These showers became almost continuous, and towards noon only momentary glimpses of the land were to be obtained at long intervals. The tides here are very swift, and when the sky cleared a strong ice-glint was to be seen ahead. It was considered dangerous to attempt to enter the ice in such weather, with the unknown Mill islands directly in the course; we therefore turned back to pass south of Nottingham island. This decision proved wise, for next day the whole mouth of Fox channel was found completely filled with heavy ice drifted south from the northern parts of that channel. The condition of the *Neptune's* stem did not warrant any contact with the ice that could possibly be avoided.

The northern side of Salisbury island rises directly from the water in granite cliffs to elevations varying from 500 to 1,000 feet. The surface of the island appears to be very rugged and barren. As a rule the shores are without harbours along this side, but at both ends there are deep bays protected by rocky islands, where safe harbours would be found if the water did not prove too deep. In all of the many soundings taken along the island, no bottom was obtained at two hundred and twenty fathoms; this is consequently the deepest water in Hudson bay and strait. Two large icebergs were grounded off the eastern end of the island, while a third very large one had penetrated to the head of the bay at the northeastern end and was aground close under the rocks. As these bergs must have come from Davis strait, there being no glaciers on the lands fronting on Hudson bay, they show a strong current from the eastward along the northern side of the strait.

On the 13th, having rounded Salisbury and Nottingham during the night, ice was met with at nine in the morning, twenty-five miles to the westward of the last mentioned island. The

course was changed to south of west to skirt the edge of this great pack, and as it continued unbroken to the westward, the idea of passing through Fisher strait was abandoned, and the course was laid to the southward of Coats island. The passage was encumbered by ice until dark, when the ship lay-to awaiting daylight. The low southern shore of Coats was then followed westward to Cape Southampton, after which we headed away direct for Fullerton. When within a few miles of that place, on the evening of the 15th, we came up with the Scotch whaler *Active,* now bound homeward from Repulse bay. Captain Murray came on board, seeking the doctor. From him we learned that the *Active* had passed us, on our way out, on the 20th of July, when leaving the eastern entrance to Evans strait. She had come in early in the month, and after landing a number of miners at Lake harbour, on the north side of the strait close to the eastern end of Big island, had taken on board a large number of Eskimos from that place and from the vicinity of Kings cape, at the entrance to Fox channel. Great difficulty had been experienced in the ice while crossing Fox channel. Subsequently, little ice was met with until the ship reached Repulse bay, which was still solidly frozen, so that the *Active* did not get into the harbour there until the 10th of August. Frozen strait remained full of ice all the season. The *Active* and the whaling station in connection with it at Repulse bay both had a successful season. The catch of the steamer included thirty-three white whales, thirty-six walrus, and one Right whale affording 1,300 pounds of bone. The returns of the station were twenty-eight musk-ox skins, thirty white whales, and one small Right whale with 500 pounds of bone. In 1903 the combined catch included five Right whales with a total of 40,000 pounds of bone.

The *Active* on her way out would pass through Fisher strait, in order to hunt walrus at Walrus island and on the floating ice on the eastern side of Fox channel. Part of the large crew of

natives would be put ashore at Kings cape and the remainder at the mica mine, where the results of the season's mining, some thirteen tons, would be taken on board, together with the white men there, and the ship would leave for home about the 1st of October.

The *Era* had been met in Repulse bay, and had at that time not added to her catch since we left Fullerton. Captain Comer was again to winter in Fullerton harbour, and was on his way south to go into winter quarters. Including the crew, the *Active* had one hundred and twenty-three persons on board; the ship is quite small, and the accommodation and crowding can be imagined.

Fullerton was reached next morning, and we were soon boarded by the police detachment and our old Eskimo friends of the past winter. During our absence Staff-Sergeant Dee had made an exciting trip to Repulse bay in a whaleboat manned by natives.

The day after our arrival the *Era* entered the harbour, and Captain Comer reported the lack of success mentioned above.

We remained at Fullerton until the 25th, being busily employed in the meantime with landing provisions and coals for the police, shifting coal, and taking aboard ballast. Two of the policemen who had been left here in the spring were found to be seriously ill, and on the doctor's certificate were taken on board invalided home.

The homeward voyage from Fullerton to Port Burwell was made in fine weather, and the only incident requiring mention was that the ice from Fox channel had advanced southward and westward nearly twenty miles since we last saw it. This necessitated our keeping close to Mansfield island. Our pilot was safely returned to his home in Wakeham bay, and Port Burwell was reached on the 1st of October.

The ship had not been at anchor in the harbour for an hour, when the *Arctic,* with Major Moodie and Captain Bernier, came in. Major Moodie brought the welcome word of recall to the *Neptune,* and after procuring some articles of equipment from us left again that evening, being in a great hurry to reach Fullerton before the harbour froze over.

A heavy gale of southeast wind kept us in the harbour until the morning of the 4th, when we rounded Cape Chidley and turned south bound for home. A fine passage was made down the Labrador coast, and on the evening of the 7th we reached Chateau, where telegrams were sent announcing our safe arrival. The trip across the Gulf of St. Lawrence and along the coast of Nova Scotia was rough. We arrived in Halifax on the 12th, looking somewhat weather-beaten, as was only natural after nearly fifteen months' absence.

I cannot close this narrative without expressing the deep feelings of gratitude I bear towards Captain Bartlett and the officers and crew of the *Neptune,* for their unfailing and cheerful attention to duty throughout the voyage, an attention which rendered my leadership both easy and enjoyable.

South Coast of North Devon Island.

CHAPTER IV.

AN HISTORICAL SUMMARY OF THE DISCOVERIES AND EXPLORATIONS IN ARCTIC AMERICA.

A SUMMARY of Arctic explorations must be confined to a brief statement of the objects and achievements of the various expeditions, and in consequence loses the charm of the matter of fact manner in which the dangers, difficulties and hardships are recorded in the different narratives.

The history of the exploration of the American Arctics opens with the first voyage of Sir Martin Frobisher, in 1576, and practically closes with the return of Sverdrup in the *Fram,* in

1902. The great land masses of the Arctic islands have now been outlined, and all that remains to be done is to fill in minor details.

The acquirement by Spain of all the richer parts of America followed close on the discovery of Columbus; at the same time Portugal laid claim to the southern route, by the Cape of Good Hope, to India and China, in consequence of the discoveries of Vasco da Gama.

England was thus debarred from these new fields of wealth, and it was the search for a northern and unclaimed passage to the East which stimulated, in the reign of Elizabeth, the awakening enterprise of London and Bristol merchants to outfit expeditions under brave and adventurous seamen.

The first attempt was made to the eastward, around the northern coasts of Europe and Asia. Although failing in the main object, a large and profitable trade was opened with northern Russia, which led to the founding, by Sebastian Cabot, of the Muscovy Company of London in 1553.

This company, through selfish motives, was unfavourable to the prosecution of a search for a northern passage to the westward, and nothing was attempted in that direction until 1576. In that year Sir Martin Frobisher, filled with enthusiasm by accounts of a mythical Strait of Anian, which was said to afford a safe passage between the Atlantic and Pacific, through the north temperate regions of America, resolved to explore the strait. Aided by powerful friends, he overcame the opposition of the Muscovy Company, and under the direct patronage of the Queen, he succeeded in outfitting three small clumsy vessels, two being of twenty-five tons burden each, the third being a pinnace of ten tons. These he provisioned for twelve months, and with the combined crews, numbering thirty-five persons, sailed from the Thames. High pinnacle land, covered with snow, was seen on the 11th of July, in N. latitude 61°. Off

this land the pinnace foundered with all on board, and his other consort, deserting, returned to England.

Continuing westward alone, in a leaky ship with a sprung mast, high land was again seen on the 28th of July. Frobisher named this land Queen Elizabeths Foreland, but it was not until the 10th of August that a landing was effected. The following day, in N. latitude 63°, he entered the bay which bears his name, thus being the first to reach the great island of Baffin. He sailed a considerable distance up the bay, believing the land on his right hand to be the coast of Asia, while that to the left was the continent of America. The land on the north side of the entrance to the bay he named the North Foreland, while Queen Elizabeths Foreland forms the southern point. While in the bay four of the crew landed without permission, and were never seen again; in revenge for their supposed murder by the Eskimos, one of the latter was seized and carried to England, where he died shortly after arriving.

On his return to England, Frobisher was greatly commended for his voyage, especially for the hope he brought of a safe passage to China, and the Queen named the lands bounding the supposed strait, Meta Incognita.

A piece of 'black earth' picked up on Hall island was submitted to an alchemist, Baptista Angello, who 'by coaxing nature' obtained some gold from it, or said he did. On the strength of this discovery, money was immediately raised for a second expedition, with the sole purpose of bringing back ore. Three ships were again sent out under Frobisher, and returned well laden with the supposed ore. During the stay of the expedition in Frobisher bay several skirmishes took place with the natives, a number of whom were killed.

Fifteen ships were fitted out in 1578 for the third voyage, to bring home ore. Carried southward by strong currents, the fleet entered what was later called Hudson strait, and sailed several days westward through it before the mistake was dis-

covered. If Frobisher had been on a voyage of discovery he might easily have entered Hudson bay, but the search for gold being the object he turned back, and entered Frobisher bay by passing through the strait to the east of Resolution island. On the 1st of August most of the fleet was assembled at the Countess of Warwick island, where the ore was mined, and all the ships loaded by the end of the month. The ore finally proving worthless, nothing further was done to continue the discoveries of Frobisher.

Ten years after the last voyage merchants of London determined to fit out another expedition to search for the northwest passage. The enterprise was entrusted to John Davis, 'a man well-grounded in the art of navigation.' Two vessels, the *Sunshine* and the *Moonshine,* were employed for the first voyage, with a combined crew of forty-two persons. Davis, on his outward voyage, landed on the southern coast of Greenland, and named the coast the Land of Desolation. One fiord in latitude 64° 15′, where the mission stations of Godhaab and Nye Hernhut are located, he named Gilbert's Sound. Leaving here, Davis stood to the westward and northward for five days, and on the 6th of August, 1585, discovered land in latitude 66° 40′, quite free from ice. He anchored in the mouth of Exeter sound under Mount Raleigh, calling the north foreland Dier's cape and the southern one Cape Walsingham. From here he coasted southward along the land, and rounded the Cape of Gods Mercy into Cumberland gulf, up which he sailed for sixty leagues to some islands. On his return he discovered that Cumberland gulf was separated from another long inlet, which, not recognizing as Frobishers bay, he called Lumlie's inlet. Having crossed the mouth of this inlet, Davis then crossed to the south side of another great inlet, and renamed its northern point Warwick's Foreland, while the south cape was named after John Chidley. Davis remarks on the strong tides met with in the entrance to Hudson strait.

On his second voyage Davis coasted the American shore from the 67th to the 57th degree of latitude, but added nothing to his previous discoveries to the northward of Hudson strait. Keeping near the Greenland coast, on his way northward, Davis on his third voyage reached latitude 72° 15′. The northern coast of Greenland he called the London coast. Leaving this, he sailed west for forty leagues, where he fell in with the ice of the ' middle pack ' of the whalers; a strong gale then forced him south along the edge of the ice, so that no land was seen either to the west or north.

George Weymouth was the next adventurer to seek the northwest passage. He was fitted out by the Muscovy Company in 1602. On the 28th of June, in the *Discovery,* he reached Warwicks island, between Frobisher and Cumberland bays, and sailing northward he passed Cape Walsingham and nearly reached the 69th parallel, when the crew mutinied and forced him to return south. Passing around Hatton headland on Resolution island, he sailed a considerable distance up Hudson strait, and then returned to England, where he arrived on the 5th of August.

Captain John Knight, in the *Hopewell,* sailed in 1606, but the voyage terminated speedily and disastrously by the death of Knight, his mate and three of the crew, who were surprised and slain by the Eskimos.

Undeterred by these unsuccessful attempts, Sir John Wolstenholme and Sir Dudley Digges, in 1610, resolved to employ the *Discovery,* of fifty-five tons, in searching for the northwest passage, and nominated Henry Hudson to the command. He had proved his worth on previous voyages to Spitzbergen and to the Hudson river. On this, the last of his voyages, he first sighted the south shores of Greenland; eleven days later he entered Frobisher bay, but was soon turned back by ice, and so passed south into Hudson strait, which he followed westward into Ungava bay, where he was greatly obstructed by ice. Pass-

ing Akpatok island, which he named Desire Provoketh, on the 11th of July, he reached the islands of Gods Mercies, and thence sailed along the south shore of the strait, naming it Magna Britannia. He passed into Hudson bay on the 2nd of August, through a strait about two leagues broad. The southern head of this was named Cape Wolstenholme and the northern one, on an island, Cape Digges; a bold headland six leagues to the northward was called Salisburies Foreland (Salisbury island). Hudson's journal ends on the 3rd of August, and the remainder of the melancholy story is told by Abacuk Pricket, who states that they were frozen in, on the 10th of November, in the south-east part of the bay, after sailing three months through a labyrinth of islands. Dissensions had early sprung up among the crew, and in the June following a mutiny broke out headed by Robert Juet and Henry Greene. On the 21st Hudson was seized by the conspirators, and, with his young son, forced into a small boat. The carpenter, John King, accompanied him voluntarily, while six sick men were also forced into the boat, which was cut adrift, never to be heard of again. On the way home Juet and other of the leading mutineers were killed by the Eskimos at Cape Digges, and the remainder only reached England after great sufferings from famine and other hardships.

In 1612, Sir Thomas Button, accompanied by Bylot and Pricket of Hudson's crew, entered Hudson strait through the channel between Cape Chidley and Button islands. Having passed the strait, he continued westward, passing the south end of Coats island, which he named Cary's Swan's Nest, and reached the western side of the bay, to the northward of Chesterfield inlet, where he named the land 'Hopes Checked,' because his progress westward was thus arrested. Turning south, he followed the coast to the mouth of the Nelson river, where he wintered. His crew suffered greatly from scurvy, but an abundant supply of birds and fish in the spring recruited the strength of the men sufficiently to allow them to continue the

voyage. This is memorable as the first instance of a crew wintering in the north and being sufficiently healthy to remain the following summer. This year's voyage ended in latitude 65°, near Whale point in Roes Welcome. On the homeward voyage Button passed close to a large island south of Southampton, which he called Mansell, and not Mansfield, as it is now written.

The following extract from Prince Henry's instructions for Button, dated 5th of April, 1612, shows the accurate knowledge of Hudson strait possessed at that early date: 8. 'Being in; we holde it best for you to keep the northern side, as most free from the pester of ice, at least till you be past Cape Henry; from thence follow the leading ice, between King James and Queen Anne's Foreland, the distance of which two capes observe if you can, and what harbour or rode is near them, but yet make all the haste you maie to Salisbury island, between which and the northerne continent you are like to meet a great hollowe billowe from an opening and flowing sea from thence.'

In the same year, James Hall and William Baffin went to the west coast of Greenland in search of a gold mine, at Cunningham fiord near the Arctic circle, which was reported to have been worked by the Danes. No ore was found, but traces of old workings were discovered.

Baffin, accompanied by Bylot, sailed through Hudson strait in 1615. He then passed north by Mill island and traced the northeast shore of Southampton island, from Sea-horse point to Cape Comfort, the last being according to his observations in latitude 65° N., longitude 85° 22′ W. Doubling this cape, the tide was found to set differently from what had been expected, and gave no hope of a passage in that direction, so he turned back. The following extract from Baffin's journal gives his opinion as to the possibility of a passage westward being found leading from any of the channels entering Hudson bay:—'And now it may be that some expect that I should give my opinion

concerning the passadge. To those my answere must be, that doubtless there is a passadge. But within this strayte, whome is called Hudson's straytes, I am doubtfull supposinge the contrarye. But whether there be or no, I will not affirme. But this I will affirme, that we have not been in any tyde than that from Resolutyon Iland, and the greatest indraft of that cometh from Davis' straytes; and my judgment is, if any passadge within Resoluyton Iland, it is but som creeke or inlett, but the maine will be up *fretum Davis.'*

In accordance with this opinion, in 1616, Baffin sailed up Davis strait, his instructions being to reach if possible the 80th parallel before turning westward. By following the Greenland coast he was able to reach Horn sound in latitude 74° before being greatly embarrassed by ice. Here he met a band of Eskimos, with whom he traded for narwhal horns and walrus teeth. Being liberated from Horn sound, Baffin continued northward past Cape Digges, in latitude 76° 35′, and across the entrance of Wolstenholme sound to Whale sound, where he was again beset in the ice during a gale. After being released, he passed Hakluyt island and reached the offing of a great sound extending northward of the 78th parallel of latitude; this he named after Sir Thomas Smith. This was the northern limit of the voyage. He now turned south, passing Cary islands, and on the 10th of July anchored at the mouth of Alderman Jones sound, where a great number of walrus were seen, but no natives. On the 12th Sir James Lancaster sound was discovered, but could not be entered on account of the ice across its mouth. Baffin could not penetrate these sounds owing to the strong westerly winds blowing out of them. Finding the 'middle pack' immediately south of Lancaster sound, thickly jammed on the western shore, Baffin stood across to the Greenland coast, in more open water, and so returned home. In his report Baffin says that after having coasted nearly all the way round, he considers it nothing but a great bay, and draws

attention to the importance of the whale fishery, which soon after was begun, and lasts to the present day.

About this time a Danish expedition, under the command of Jens Munck, sailed into Hudson bay and wintered in the mouth of Churchill river. The ships were unprepared for a winter in the north, and, consequently, the crew suffered terribly from the ravages of scurvy, so that in the spring, out of fifty-two persons only Munck and two others survived. These fortunately procured some grasses from under the snow, and as the water opened killed ducks and fish enough to give them strength to repair the smaller vessel, in which they reached home.

The Muscovy Company, in 1631, again decided to send out an expedition to search for a passage from Hudson bay, and entrusted the command to Captain Luke Fox. Having passed through Hudson strait he landed at Cary's Swan Nest, and then rounded the southwest point of Southampton island, and proceeded to explore the channel between that island and the mainland, up to latitude 64° 10′, where he saw an island near the mainland, which he named Sir Thomas Roe's Welcome, a name now applied to the channel as a whole. Fox's instructions limited him to the coast south of latitude 63°, so he now stood to the south along the shore, passing Marble island, which he called Brooke Cobham, and the mouth of the Churchill river, and reaching Nelson river on the 10th of August. Keeping a southerly course for a fortnight longer, he fell in with Captain James near Cape Henrietta Maria. Having convinced himself that there was no opening to the west between latitudes 65° 30′ and 55° 10′, Fox turned northward and explored Fox channel to the east of Southampton island, naming the prominent points on the west side of Baffin island, King Charles his Promontory, Cape Maria, Lord Weston's Portland and Point Peregrine, the last being the most northerly point reached.

Captain James was in command of a rival expedition, fitted out the same year, with instructions to explore to the south of

the track taken by Fox. After parting with Fox, he sailed southward along the west coast, thoroughly examined it, and after several narrow escapes from shipwreck through grounding on shoals, finally ran his ship aground on Charleton island, and there passed the winter. James gives a woeful tale of the hardships caused by cold, lack of food and scurvy. He states that the cold was so intense that wine, sack, oil, vinegar and even brandy froze solid; that the cook soaked his salt meat near the fire to prevent it from freezing, and that the side near the fire was found to be warm while the opposite side was frozen an inch thick. This is a sample of James' report, and shows what reliance may be placed on his other statements.

From the time of Charles I. to that of George I. England was convulsed with civil war and revolutions, and was at war with other nations abroad, so that for nearly a century after Fox no maritime discoveries were undertaken, and nothing would have been done in the north but for the foundation of the Hudson's Bay Company.

Two French Canadian fur traders, named Radisson and Chouart *dit* Groseilliers, had for a number of years traded and lived with the Indians in the country north and west of Lake Superior, learning much about the great sea to the north, and the canoe routes leading to it. They visited its southern shores in 1659, and on their return to Quebec endeavoured to enlist prominent merchants there in a scheme to establish permanent trading posts on the bay, to be supplied by ships from Canada or France. Being unsuccessful, they crossed to Paris, where they found no one to advance the capital necessary to start the project. The English ambassador, hearing of their scheme, sent them to London, where they interested Prince Rupert and several influential men of the court and city.* These advanced

* Another version, however, of the origin of the Hudson's Bay Company, states that the two Frenchmen went to Boston, New England, where they met Sir George Carteret (or Cartwright), who gave them letters of introduction to King Charles.

sufficient money to outfit a small vessel, under the command of Zachariah Gillam, a New England captain, who, accompanied by Groseilliers and Radisson, sailed through Hudson strait and down the bay to the mouth of Rupert river. Here friendly intercourse was held with the natives, and a small fort was built, in which the party successfully wintered.

On the return of Gillam, in 1669, Prince Rupert and his associates applied to Charles II. for a charter. This was granted on the 2nd of May, 1670, to the Governor and Company of Adventurers trading from England to Hudson bay. It states that 'in consideration of their having at their own cost and charges undertaken an expedition to Hudson bay in the north-east parts of America, for the discovery of a new passage to the South sea, and for the finding of some trade for furs, minerals and other considerable commodities, and of their already having made by such their undertakings such discoveries as did encourage them to proceed farther in pursuance of the said design, by means whereof there might probably arise great advantage to the King and his Kingdom, absolutely ceded and gave up to the said undertakers, the whole trade and commerce of all those creeks, seas, straits, bays, rivers, lakes and sounds, in what latitude soever they may be, which are situated within the entrance of the Hudson's straits, together with all the countries, lands and territories upon the coasts and confines of the said seas, &c., so that they alone should have the right of trading thither, and whoever should infringe this right, and be found selling or buying within the said boundaries, should be arrested and all his or their merchandises should become forfeit and confiscated, so that one-half thereof should belong to the King and the other half to the Hudson's Bay Company.'

In 1670 the newly formed company sent out Charles Bayly, as Governor, to establish Fort Rupert at the mouth of Rupert river, in latitude 51° 30′, thus establishing their sovereignty by right of the first permanent habitation of the territory granted

to them by the King, whose right was that of discovery by Hudson.

The French soon felt the competition of the English trading posts on Hudson bay, and sought to oust them, claiming the territory about Hudson bay by right of discovery and possession. They claimed that in 1656 the Sovereign Council of Quebec authorized Jean Bourdon to make discoveries in Hudson bay, and that he proceeded there, took possession in the name of the King of France, and made treaties of alliance with the natives. This claim is disproved by the journal of the Jesuits for that year, which relates that Bourdon sailed on the 2nd of May, and returned on the 11th of August, having been stopped by ice on the coast of Labrador, where a Huron Indian was killed by the Eskimos.

The Governor of Canada, D'Argenson, in 1661, despatched Dablon, a Jesuit missionary, accompanied by Druillette de Vallière, to the country about Hudson bay. They travelled by way of the Saguenay, but did not reach the watershed, their guides refusing to proceed on account of Iroquois war parties being between them and Hudson bay. The ravages of the Iroquois were such that no travel was possible in the north until 1663, when Sieur de la Couture with five men, it is claimed, proceeded overland to the bay, took possession of the territory in the name of the King of France, noted the latitude, planted a cross, and deposited His Majesty's arms engraved on copper at the foot of a large tree. Sieur Duquet and Jean L'Anglois are said to have visited the bay the same year, by order of D'Argenson, and to have there set up the King's arms. No mention of these important expeditions occurs in the *Relations des Jésuites*. The first Frenchman whose visit to the bay is undisputed, was the missionary Albanel, who crossed by way of the Saguenay and Rupert rivers, arriving at the mouth of the latter on the 28th of June, 1672, where he found a small fort and a boat belonging to the English traders.

The Hudson's Bay Company, always energetic in establishing trading posts wherever the Indians congregated about the shores of the bay, had, by 1685, small forts at the mouths of the Albany, Moose, Rupert, Eastmain, Severn and Nelson rivers. All were trading posts except Eastmain, where a mica mine was worked for a few years, but finally abandoned as unprofitable. No attempts were made to carry the trade inland in direct competition with the French, whose *coureurs de bois* the English appear to have held in great respect.

Many complaints were soon made to the Governor of Canada by merchants and missionaries that the English posts on the bay were ruining the fur trade and demoralizing the natives; and he, knowing no affront in this quarter would cause James II. to break with Louis XIV., resolved, in a time of peace, to take possession of the English forts. The Governor accordingly sent a detachment of soldiers, under the command of Chevalier de Troyes, overland from Quebec, who, almost without a struggle, took possession of Rupert, Moose and Albany forts. This was the commencement of an intermittent warfare between French and English on Hudson bay, lasting until the treaty of Utrecht, in 1713. In 1690 D'Iberville sailed from Quebec with two ships to capture Fort Nelson, but was unsuccessful. War having been declared between England and France in 1693, the Company, assisted by warships, retook Albany, Moose and Rupert forts. The following year D'Iberville, with two ships and one hundred and twenty men, took Fort Nelson from the English; while a strong force, sent overland from Canada, easily recaptured Albany and Rupert forts. These latter places were a second time recovered by the assistance of the warships *Bonaventure* and *Seaford,* in 1695: while in the following summer Fort Nelson was recovered with the aid of four warships.

In 1697 D'Iberville again visited the bay, where he destroyed the English ships amongst the ice, and afterwards took Nelson, renaming it Fort Bourbon. By the treaty of Ryswick, signed

in this year, each country returned to the other all places taken during the war, and retained those captured previously, thus leaving to the company the possession of Albany only.

Affairs remained in this condition until the treaty of Utrecht, in 1713, when the French relinquished all claims to the territory about Hudson bay.

The first attempt at exploration inland was made by the Hudson's Bay Company, in 1691, when Henry Kelsey, by order of the Governor at Nelson, accompanied some Indians to the interior. From his diary, it would appear that he journeyed, in a canoe, some distance up the Nelson river, and then tramped overland to the open country north of the Saskatchewan.

In 1719, the Company made extensive preparations for an exploration of the northern parts of Hudson bay. The expedition consisted of a frigate, commanded by Captain Vaughan, and a sloop by Captain Barlow, the chief command being entrusted to Captain James Knight, who had been governor of a number of the forts, but who was eighty years of age. The expedition sailed from England in June, well stored with provisions, with a house in frame and a large stock of goods for trade. Their instructions were to proceed to the northward, by Sir Thomas Roe's Welcome, as far as 64° latitude, in search of the Anian strait. As the ships did not return to England in 1720, fears were entertained for their safety, and orders were despatched by the next ship to send the *Whalebone,* John Scroggs, master, in search of them. The instructions reached Churchill too late to be acted upon that season, and Scroggs did not sail until 1722. After considerable trouble with shallow water and shoals along the coast, he managed to reach Marble island, where pieces of wreck were found, but they were considered of no importance by Scroggs, who returned without continuing the search. Hopes were long entertained that Knight had made his way to the Pacific, and it was not until 1767 that the fate of the expedition became known. That year

the Company started a whale fishery at Marble island, and one of the boats engaged in the fishery accidently discovered a harbour near the east end of the island; at its head guns, anchors, cables and many other articles were found. The wrecks of the ships lay in five fathoms of water, and the remains of the house were still in existence, with two skulls on the ground near by. Hearne learned from the Eskimos that the ships arrived late in the summer, that the larger one received much damage entering the harbour, that soon after arriving the house was built and that the white men numbered about fifty. When the natives again visited them, during the following summer, their number was greatly reduced, and the remainder were unhealthy. The carpenters were then at work on a boat. By the beginning of winter the number was reduced to twenty, and in the following summer only five remained alive, all of whom died within a few days after the arrival of the natives. That such a disaster could occur within two hundred and fifty miles of Churchill is astonishing at the present day, when so much more is known of the comparative ease with which long journeys may be made over the snow and ice in the springtime.

After this disastrous termination of their first expedition by sea, the Company was not eager to undertake another, but they were practically forced to do so by Arthur Dobbs, a zealous and enthusiastic advocate of the northwest passage. On his insistence, two sloops were sent northward from Churchill, in 1737, to open trade with the natives, and to look for a northern passage to the westward; the latter seems never to have been seriously undertaken, and did not at all satisfy Dobbs.

In 1741, Captain Middleton, who had been long in the service of the Hudson's Bay Company, was selected by the Admiralty to conduct an expedition of discovery up the Welcome. He sailed with two small vessels, and wintered at Churchill. The following summer he proceeded northward, and discovered Wager inlet and Repulse bay, the south headland of which he

named Cape Hope. Being unable to proceed farther on account of ice, he walked fifteen miles to a high point, from which he saw a frozen strait, turning round the north end of Southampton island, with the flood tide coming from Fox channel into Repulse bay. On Middleton's return, Dobbs was greatly disappointed, and preferred charges against Middleton to the Admiralty, accusing him of want of honesty in the report of his proceedings, and of concealing everything that told in favour of a passage, so that he might serve the interests of the Hudson's Bay Company, which he, Dobbs, alleged would be injured by the discovery of a northwest passage. The honest reply of Middleton and the evidences which he adduced of the truth of his statements satisfied the Admiralty, but it was not until eighty years later that the correctness of his statements was verified by Parry. In the meantime Dobbs had influence enough to procure the passage of an Act of Parliament, offering a reward of £20,000 for the discovery of a northwest passage; and was also instrumental in raising sufficient money to outfit two ships to earn the reward. They sailed in 1746, and wintered at Port Nelson. Their captains agreed only on one point, and that was that they were not expected to explore Repulse bay and the Frozen strait, and, after an examination, that Wager inlet could connect only with the Welcome. On the 25th of August a council was held, and a 'definitive resolution was taken to bear away without further delay for England'—'the discovery being finished,' as the narrative puts it. Both ships had entered Chesterfield inlet, which had been examined as far as an overfall or cascade. The account of this was not thought satisfactory in England, so, to settle the question the Hudson's Bay Company sent Captain Christopher in a sloop to examine it again, in 1761. On his return he reported that he had navigated the inlet for more than 150 miles in a westerly direction, until he found the water fresh, but had not seen its end. On this, Mr. Norton was sent, in 1762, to trace it to its extremity, which he did, and

found it to end at a distance of 170 miles from its entrance, in a fresh water lake seventy-two miles in length, and from twenty to twenty-five miles wide. In 1791 Captain Duncan examined, for the Hudson's Bay Company, Corbets or Rankin inlet, which proved to be a bay, and Chesterfield inlet, which he found to agree with Norton's description.

Samuel Hearne, a clerk in the service of the Hudson's Bay Company, started, in 1770, with a party of Chipeweyan Indians, and travelled overland on foot to the mouth of the Coppermine river, where the Indians massacred a number of Eskimos. On his return journey he passed Great Slave lake, and reached Fort Churchill in safety after one of the most remarkable journeys ever accomplished.

This ended for many years the attempts of the Hudson's Bay Company at northern exploration, their undivided energies being required to maintain the trade struggle with their energetic rivals, the North-west Company.

Previous to the conquest of Canada, the French fur traders had carried their trading posts beyond the great lakes, across the wooded country to Lake Winnipeg, and thence up the Saskatchewan to the foot of the Rocky mountains. Shortly after the cession, a number of Scotch and Canadian merchants acquired the rights of the old French company, and prosecuted the trade with such increased vigour as to greatly diminish that of the Hudson's Bay Company, who in self-defence were compelled to establish trading posts inland close to those of their rivals. In this manner the interior of British America was soon dotted with trading stations that extended over the whole territory from the bleak shores of the Atlantic to and beyond the Rocky mountains. The strong rivalry for furs soon led to collisions between the partizans of both companies, and blood was often shed; the natives were debauched with liquor, and general lawlessness continued until the amalgamation of the companies in 1820.

The wars with the American colonies and with France occupied the undivided attention of the British nation until after the final fall of Napoleon, and during this period nothing was done to further the renewal of the search for a northwest passage, until 1817, when Captain Scoresby published an account of the great disruption of the ice in the Greenland seas, and pointed to the ease with which explorations might then be carried on in the Arctics. He was aided by Sir John Barrow, secretary to the Admiralty, who, by his writings and personal influence, induced the British government to again undertake a series of Arctic explorations.

Two ships, well equipped for wintering in the north, were fitted out to explore the regions westward of Davis strait. The *Isabella,* commanded by Captain John Ross, and the *Alexander,* by Lieutenant William Edward Parry, were selected for this undertaking. They sailed on the 3rd of May, and were first stopped by ice just north of Disko island on the 17th of June. Melville bay was crossed with some difficulty, and a delay of a week occurred near Cape York. At midnight on the 19th of August the *Isabella* was in latitude 76° 54′ N., with the Cary islands bearing southeast; this was the most northerly point reached. Ross considered Smith sound a closed bay, and named the capes forming each side of it Isabella and Alexander, after the ships. He stated that the sound probably extended eighteen leagues; sailing down the western side, the mouths of Jones and Lancaster sounds were passed, both free from ice, but Ross did not enter them. He described Lancaster sound as closed by the Crocker mountains. The expedition returned to England in October, having practically accomplished nothing beyond confirming the statements of Baffin made many years before.

The report of Ross was not thought conclusive by the Admiralty, and in 1819 the *Hecla* and *Griper* were commissioned to explore Lancaster sound. Lieutenant Parry was given command in the *Hecla,* with Lieutenant Mathew Liddon in the

Griper. The ships, without much difficulty, reached the mouth of Lancaster sound, and sailing over the supposed Croker mountains, continued westward past Regent inlet on the south, and Wellington channel and Byam Martin channel on the north, reached the south side of Melville island, where the winter was safely passed by both ships in a small cove called Winter harbour. The following summer an attempt was made to penetrate the heavy arctic ice which forms a perpetual barrier across the strait between Melville island and Banks island; this proving impossible, the expedition returned safely to England in October, 1820. Parry on his voyage passed over nearly half the distance between the Atlantic and Pacific, and saw from his farthest western point the shores of Banks island beyond the middle of that distance. He laid down, on the north of his track, the chain of islands bearing the names of North Devon, Cornwallis, Bathurst and Melville; and on the south, North Somerset, Cape Walker and Banks.

Sir W. E. Parry, in 1821, made his third voyage to the Arctic islands, in command of the *Fury,* having as second in command Captain G. F. Lyon, in the *Hecla.* This time the attempt was made through Hudson strait and up Fox channel. The first season, he examined Repulse bay and went into winter quarters at Winter island, a few miles beyond the eastern entrance of the Frozen strait of Middleton, whose accuracy was proved after being long clouded by the reckless attacks of Dobbs. The ships were released from the ice on the 28th of June, and no time was lost in pushing northward, until stopped by the heavy ice off the eastern mouth of Fury and Hecla strait, where the remainder of that season and the early part of the next were spent in trying to pass through the strait, the eastern part of which remained continuously blocked with heavy ice.

A fourth time Parry tried to make the northwest passage, by way of Regent inlet. This attempt was terminated by the shipwreck of the *Fury,* commanded by Captain Hoppner. With

great forethought, Parry caused all the provisions to be landed from the wreck and safely housed on Fury beach, where they were subsequently found by Ross, and were the means of rescuing his crew from starvation.

During the time that Parry was making his important discoveries by sea, Lieutenant John Franklin was employed in tracing the northern shores of the American continent. From 1819 to 1822 Franklin was engaged in leading an expedition overland from Hudson bay to the Arctic shores, in the vicinity of the Coppermine river. The Admiralty, who planned the expedition, knew practically nothing about the conditions for travel through the regions that it purposed exploring, and depended for aid solely upon the Hudson's Bay Company. Unfortunately, at this time the quarrel between the Hudson's Bay Company and the North-west Company was at its height, and the resources of both were consequently greatly crippled. The North-west Company were far stronger in the Mackenzie river valley, and their rivals, who were to help Franklin, were unable to give him very efficient aid, or to supply him with a large stock of provisions; in consequence, he started from the outposts with almost no food, determining to trust to his hunters for the provisions required for his party. This finally led to disaster, and on the retreat from the Arctic sea, over one-half of the party, including Lieutenant Hood, died of starvation. Franklin left England in the Hudson's Bay Company's ship, accompanied by Lieutenants Back and Hood, Dr. Richardson and one seaman. They arrived at York Factory, and there met four of the leading partners of the North-west Company, who were held prisoners by their rivals. As these men had spent a number of years in the Mackenzie river country, Franklin obtained much valuable information from them. After a few days at York, the party proceeded by canoes from there, 650 miles to Cumberland House, on the Saskatchewan river, where the first winter was passed. The following summer

the party, reinforced by a number of Canadian voyageurs, started northward in canoes, and reached Fort Chipewyan, on Great Slave lake, before the ice had melted. The expedition, now consisting of twenty-five persons, started away from Fort Chipewyan with one day's supply of provisions and a totally inadequate amount of ammunition. Travelling to the north side of the lake, the party was further increased by a band of the Copper Indians, and all journeyed to Fort Enterprize, which was built near the edge of the barren lands, in latitude 64° 30′ N. The total distance travelled during this season was 1,350 miles. Venison was plentiful during the winter, but the supply failed in the spring, so that a start was made over the barrens without any food except such as fell to the hunters from day to day. The distance from Fort Enterprize to the mouth of Coppermine river is 334 miles. The first 120 miles were made by tramping with canoes and outfit over the snow; the remainder was made in canoes, and the mouth of the river was reached on the 21st of July. Turning eastward, the shores of Bathurst inlet and Coronation gulf were surveyed to Point Turnagain, in latitude 68° 19′ N. and longitude 109° 25′ W. The canoes were detained here for several days by a snowstorm, and a retreat was necessary as soon as the weather moderated. The course along the coast was therefore retraced to Hood river, and that stream was ascended for a short distance. The equipment was reduced to the smallest compass, and a course was shaped overland for Fort Enterprize, the travelling being through deep snow. Game was very scarce, and the hardships soon began to tell on the weaker members of the party, with the result, as before stated, that half the number succumbed to cold and starvation. The survivors were succoured by Indians on the 7th of November, and reached the Hudson's Bay post on Great Slave lake on the 11th of December, and England in October, 1822.

In 1825-27, Captain Sir John Franklin resumed his explora-

tion of the Arctic coasts of America in much happier circumstances. The rival fur companies had now amalgamated, forming one powerful company, with full control over the natives, and capable of rendering valuable assistance to an exploring party in the far north. Franklin, profiting by his former sad experience, had a large supply of pemmican prepared in advance, and stored at Fort Chipewyan. The journey from England was made by way of Montreal and the great lakes. After passing a winter at Great Bear lake, Franklin descended the Mackenzie to its mouth, and then surveyed the coast westward to Return reef, passing the northern end of the Rocky mountains, leaving only 160 miles of unsurveyed coast between his farthest point and Point Barrow, reached the same year by Captain Beechey in boats from Bering straits.

While Franklin was thus engaged with one-half of his party, the other half, under the command of Dr. Richardson and Lieutenant Kendall, were exploring the coast between the mouths of the Mackenzie and Coppermine rivers. These surveys carried the exploration from Bering strait to Coronation gulf, with only a break of 160 miles between Return reef and Point Barrow, or through sixty degrees of longitude. The eastern end of these surveys was overlapped six degrees in longitude by the discoveries of Parry to the northward, and only a channel running north and south was required to connect them, and so complete the long sought northwest passage.

Captain John Ross, being anxious to remove the reproach of his former failure, and having been provided by Sir Felix Booth with a well-fitted ship, the *Victory,* of 150 tons, sailed, in 1829, with the intention of seeking a passage through Regent inlet. The ship was set fast in the ice, and finally abandoned in Victoria harbour, on the west side of Regent inlet, nearly opposite Fury and Hecla strait. The expedition was remarkable for the number of winters spent within the Arctic circle, three of them on the *Victory* and the fourth at Fury beach, where the

provisions thoughtfully housed by Parry were the means of saving the crew from starvation. They at length escaped from the ice in their boats, and were picked up by a whaler in Lancaster sound. Sir John Ross surveyed the shores adjoining his winter quarters, and named the lower part of Regent inlet the Gulf of Boothia.

The chief discoveries were made by Lieutenant James Clark Ross, who, by several long sled journeys, traced a part of the shores of King William island, and of the west side of the peninsula of Boothia, up to the Magnetic Pole; also the shores of Lord Mayors bay and its vicinity in the Gulf of Boothia. During the retreat to Fury beach, Brentford bay was crossed several times without notice being taken of Bellot strait.

Considerable anxiety was felt in England, after two winters had passed without any tidings of the *Victory,* and Captain Back was outfitted by public subscription to descend the Great Fish river to its mouth, and there if possible, with the help of natives, succour the crew of the *Victory.* Back spent the winter of 1834 at Great Slave lake, and the following summer crossed the height-of-land and descended Great Fish river to its mouth in a heavy boat. Having been informed, by an express from England, of the safe return of Ross, he confined himself to geographical work, and traced the estuary of the river to Cape Britannia on the one side and to Point Richardson on the other, leaving only a short distance between his northern termination and the southern point of James Ross' southern sled journey. The result of this journey left only 160 miles to the west of the Mackenzie, and thirteen degrees of longitude between Franklin's Point Turnagain and the Gulf of Boothia to complete the northwest passage.

The Hudson's Bay Company undertook to fill these gaps of unsurveyed coast-line, and sent an expedition under the direction of Peter Warren Dease and Thomas Simpson, an expert surveyor. The western section was first completed in 1837. In

1838-39 the eastern portion between Point Turnagain and the estuary of the Great Fish river was surveyed by the same intrepid explorers, without any loss of life to their party, and without other hardships than those incidental to travel in the Arctics. The boat voyages, by which these surveys were completed, were the longest ever undertaken in arctic waters, and embraced sixty-two degrees of longitude between Point Barrow and Castor and Pollux river, the most eastern point of Simpson. While surveying the coast to the eastward, Simpson charted the south side of Victoria island and the south side of King William island.

Unfortunately the advanced state of the season would not permit Simpson to connect the mouth of Great Fish river with Regent inlet, or with King William sea. This the Hudson's Bay Company resolved to complete, and in 1845 selected Dr. John Rae for the work. Dr. Rae sailed in boats from Churchill to Repulse bay, where he passed the winter, supporting his party mainly by his own skill in hunting. The following spring he portaged his boats, by a number of lakes, across the Rae isthmus to the bottom of Committee bay, and surveyed the southern part of the Gulf of Boothia to Fury and Hecla strait on the east side, and to Lord Mayors bay on the west side, thus proving that land having the width of four degrees of longitude intervened between the Gulf of Boothia and the eastern bay of the sea explored by Dease and Simpson. Dr. Rae returned in his boats to York factory in the autumn of 1847, without losing a man of his party.

In 1824 Captain Lyon, in the *Griper,* made an unsuccessful attempt to continue the work of Parry and himself in Fox channel. He left England on the 20th of June, rounded Southampton island on the 30th of August, and stood up Roes Welcome, where excessively bad weather was met with. He reached Wager inlet on the 12th of September, and when riding out a gale lost his last two anchors, while the ship was rendered

very leaky. In such a state he was unable to anchor, and was obliged to return home immediately.

A second attempt to continue Parry's work in the same region was made by Captain Back, in 1836. He was in command of the *Terror,* and left England on the 14th of June. On the first of August he was among heavy ice, off Resolution island. On the 23rd he was working through heavy ice on the east side of Southampton island, and finally nearly reached Repulse bay, where he intended to winter, when he was driven back late in September, past Cape Comfort, out into the middle of Fox channel, where the ship became fast frozen in, and drifted all winter at the mercy of wind, tide and ice. Towards the close of February the floe broke up, and the ship was caught in a pressure ridge formed between great pieces of the broken floe. In this manner the vessel continued to be tossed about and squeezed until the 16th of March, when an extra heavy squeeze lifted the ship up and left her stranded on the top of a great mass of ice, caused by the piling of large broken cakes upon one another. The *Terror* remained embedded on this mass of ice, and drifted with it until released, on the 13th of June, near Charles island, in Hudson strait. Notwithstanding the terrible usage of the ship, Back managed to caulk and fit her, so that he reached the coast of Ireland, but there had to run the ship ashore to prevent her from sinking.

The Admiralty made no further attempt at Arctic exploration for nine years after Back's disastrous trip. In 1845, they fitted out the *Erebus* and *Terror* with provisions for three years, and with the most approved systems of heating and ventilating, and other means of preserving the health and comfort of the crews. The command of the expedition was given to Sir John Franklin, with Captain Crozier, of the *Terror,* second in command. The other officers were carefully selected from among the most promising and energetic of the junior officers of the navy, while the seamen and petty officers were also of the best

in the navy. The crews leaving England amounted to one hundred and thirty-four persons, of whom five were sent home from Greenland, leaving a total of one hundred and twenty-nine on board the ships when they entered Lancaster sound, and were seen for the last time. The fate of the expedition remained for a number of years unknown, although the British government spared no expense in the attempt to rescue the unfortunate crews, and, when the hope of succouring was gone, in a search for proof of their fate. Official relief expeditions were supplemented by others under private auspices, due either to Lady Franklin or to her appeals to the sympathy of the public for convincing evidence as to the terrible fate of her unfortunate husband and his companions. America joined forces with England in the attempt to rescue the expedition, and sent out a number of ships to act in conjunction with the others, while France sent two gallant officers, one of whom, Lieutenant Bellot, lost his life while engaged in this work. As the conditions under which the searches were made were exceedingly difficult and hazardous, much time and energy were spent, and many risked and lost their lives. Twelve years passed before M'Clintock discovered undoubted proofs of the complete loss of the ships and the death of the entire crews. During this time thirty-five ships and five overland expeditions carried a host of eager searchers to the Arctics, where, incidental to their main object of rescuing the crews of the *Erebus* and *Terror*, they explored the entire northern coast-line of America and the shores of the Arctic islands, with such minute care as only their mission would warrant. To these search expeditions our intimate knowledge of Arctic America is largely due, and when the search was finished only the most northern islands remained for the future explorer.

Before entering upon a short statement of the work of the search parties, the work and fate of Franklin's expedition may be traced. His instructions were to enter Lancaster sound, and,

At Beechey Island.

when in the vicinity of Cape Walker, to penetrate to the southward and westward in a course as direct as possible to Bering strait. A quick passage appears to have been made through Lancaster sound to Wellington channel, up which the ships sailed to the seventy-seventh parallel, and then down again on the west side of Cornwallis island, returning eastward to winter at Beechey island. Many traces of a winter residence were found there, including sites of workshops, forge and observatory. Over 700 empty meat cans, all labelled 'Goldner's Patent,' were found piled in regular mounds. A large quantity of similar tins supplied to the navy had been found to be putrid, and were condemned. This had probably happened to the tins left at Beechey island, and helped to hasten the starvation of the unfortunate crews two winters later. Three seamen died during the first winter, and were buried on the island. The next information concerning the fate of Franklin was obtained from a brief record, found on King William island by M'Clintock, in 1859. The record is as follows: 'Lieutenant Graham Gore and Mr. Charles F. des Vœux, mate, left the ships on Monday, the 24th of May, 1847, with six men (to deposit papers on King William's island) '—'H.M. ships *Erebus* and *Terror* wintered in the ice in latitude 70° 5′ N., longitude 98° 23′ W. Having wintered in 1846-47 at Beechey island in latitude 74° 43′ 28″ N., longitude 91° 31′ 15″ W. After having ascended Wellington channel to latitude 77°, returned by the west side of Cornwallis island, (Sir) John Franklin commanding the expedition. All well.' This was the original record, and a most mournful addition was made to it, on the 25th of April, 1848, after another winter in the ice. Here is the addition: '—(1)848. H.M. ships *Terror* and *Erebus* were deserted on the 22nd April, 5 leagues NN. W. of this—(hav)-ing been beset since 12th Sept., 1846. The officers & crews consisting of 105 souls under the command ——tain F R M. Crozier landed here in lat. 69° 37′ 42″, long. 98° 41′—paper

was found by Lt. Irving under the cairn supposed to have been built by Sir James Ross in 1831, 4 miles to the northward, where it had been deposited by the late Commander Gore in June, 1847. Sir James Ross' pillar has not, however, been found, and the paper has been transferred to this position which is that in which Sir J. Ross' pillar was erected. Sir John Franklin died on the 11th June, 1847, and the total loss by deaths in the expedition has been to this date 9 officers & 15 men. F. R. M. Crozier, Captain & Senior Offr., and start on to-morrow 26th, for Back's Fish river. James Fitzjames, Captain H.M.S. *Erebus*.' The rest of the sad story may be shortly told: the distance to the mouth of the Fish river, from the spot where the ships were abandoned, is about 250 miles. They started from the ships dragging heavy boats on sleds. M'Clintock found one of the boats on the west side of King William island with two skeletons inside it; and the Eskimos told him that the men dropped down and died in the drag ropes. The Eskimos living at the mouth of Fish river said that about forty white men reached the mouth of the river, and dragged a boat as far as Montreal island in the estuary, where the natives found it and broke it up. The last of the survivors died shortly after the arrival of the summer birds. It is exceedingly doubtful, if their strength had lasted, whether they could have travelled over the thousand miles of barrens separating the mouth of the river from the nearest trading post on Great Slave lake, but at least a trial would have been made.

It is impossible to give in this report more than a mention of the numerous searching expeditions, and a brief summary of the geographical work accomplished by them.

1847-50—Sir John Richardson and Dr. Rae, overland, and along the coast in boats from the mouth of the Mackenzie to that of the Coppermine.

1848-50—Captain Thomas Moore, of H.M.S. *Plover*, and

Captain Henry Kellett, of H.M.S. *Herald,* and Robert Shedden, in yacht *Nancy Dawson,* to Bering sea.

1848-49—Captain Sir James Clark Ross, of H.M.S. *Enterprise,* and Captain E. J. Bird, of H.M.S. *Investigator,* to Lancaster sound.

1849-50—James Saunders, Master of H.M.S. *North Star,* to Wolstenholme sound and Ponds inlet.

1849—Dr. R. A. Goodsir, in the *Advice,* whaler, to Baffin bay.

1849—Lieutenant W. J. S. Pullen, of H.M.S. *Herald,* boat voyage from Bering strait to the Mackenzie.

1850-51—Lieutenant De Haven, of United States navy, in the *Advance;* S. P. Griffin, of the United States navy, in the *Rescue;* Captain Horatio Austin, of H.M.S. *Resolute;* Captain Ommaney, of H.M.S. *Assistance;* William Penny, Master of the *Lady Franklin,* under Admiralty orders; Alexander Stewart, Master of the *Sophia,* under Admiralty orders; Rear-Admiral Sir John Ross, in the *Felix* yacht, fitted at the expense of the Hudson's Bay Company, all to Lancaster sound.

1850—Captain C. C. Forsyth, R.N., commanding the *Prince Albert,* belonging to Lady Franklin, to Regent inlet.

1850-54—Commander Robert M'Clure, of H.M.S. *Investigator,* to Bering strait, Banks island and Lancaster sound. The crew abandoned the ship, and by walking over the ice to Beechey island made the northern northwest passage.

1850-55—Captain Richard Collison, C.B., of H.M.S. *Enterprise,* to Bering strait, Banks island, and along the continental channel to Cambridge bay, in Victoria island, near King William island.

1851—Dr. John Rae, employed by the Admiralty, descended the Coppermine, and traced Victoria island up to the parallel of the north end of King William island, in Victoria strait.

1851-52—William Kennedy, Master of the *Prince Albert,* belonging to Lady Franklin, to Regent inlet, Bellot strait and Prince of Wales island.

1852—Captain Charles Frederick, of H.M.S. *Amphitrite,* to Bering strait.

1852—Captain Edward A. Inglefield, in the *Isabel,* Lady Franklin's vessel, to Lancaster sound.

1852-55—Captain Rochfort Maguire, of H.M.S. *Plover,* to Bering strait.

1852—Dr. R. M'Cormick, a boat excursion to Wellington channel.

1852-54—Captain Sir Edward Belcher, C.B., of H.M.S. *Assistance,* to Wellington channel.

1852-54—Captain Henry Kellett, C.B., of H.M.S. *Resolute,* to Lancaster sound, Melville and Banks islands.

1852-54—Lieutenant Sherard Osborn, of H.M.S. *Pioneer,* to Wellington channel.

1852-54—Captain Francis Leopold M'Clintock, of H.M.S. *Intrepid,* to Lancaster sound and Prince Arthur island.

1852-54—Captain W. S. J. Pullen, of H.M.S. *North Star,* to Beechey island.

1853—William H. Fawckner, Master, *Breadalbane* Transport, Beechey island; crused in the ice and foundered.

1853—Captain E. A. Inglefield, of H.M.S. *Phœnix,* and Lieutenant Elliott, of the store ship *Diligence,* to Beechey island.

1853—Dr. John Rae, under Admiralty orders, by sled to Victoria island, and by boat voyage to Victoria strait.

1854—Captain E. A. Inglefield, of H.M.S. *Phœnix,* and Commander Jenkins, of H.M.S. *Talbot,* to Beechey island.

1853-54—Dr. John Rae, boat expedition at the expense of the Hudson's Bay Company, to Repulse bay, and the east side of

King William island, bringing the first intelligence of the loss of the *Erebus* and *Terror,* and of all their crews.

1853-55—Dr. Elisha Kent Kane, of the United States navy, to Smith sound, Humboldt glacier and Grinnell land.

1855—Chief factor John Anderson, of the Hudson's Bay Company, canoe voyage down the Great Fish river to Montreal island and Point Ogle, procuring further relics of the *Erebus* and *Terror.*

1857-59—Captain F. L. M'Clintock, R.N., in the *Fox,* Lady Franklin's yacht, to Peel sound, Regent inlet, Bellot strait, King William island and Montreal island, bringing precise intelligence of the fate of the *Erebus* and *Terror,* and a short record of their proceedings.

The above list is taken from ' The Polar Regions,' by Sir John Richardson, and gives a very brief statement of the numerous expeditions sent out in search of these ill-fated ships. Lengthy records of most of these expeditions have been published, in which the trials and hardships undergone are recorded in a matter-of-fact way, without any attempt to excite sympathy, and all honour should be paid to the memory of these men, many of them volunteers, for the dangers they passed through in the endeavour to rescue their fellowmen from terrible death by starvation and cold in the inaccessible Arctics. Many lost their own lives, while others drifted all winter in ships crushed between great floes of arctic ice; others, again, travelled through the northern winter, with its short days and intensely cold nights, with only a fireless tent to shield them from death in the howling storms which sweep the treeless regions; all did their duty, and were faithful unto death.

A summary made shortly after the search ended, gives the length of coast-line examined by the various searching parties as follows: Sir James Ross, in 1849, explored 990 miles of coast-line on the eastern side of Peel strait, in Lancas-

ter sound and in Regent inlet; Captain Austen traced 6,087 miles; Sir Edward Belcher and Captain Kellett, 9,432 miles; Sir Robert M'Clure, 2,350 miles; Captain Collison in his voyage to Cambridge bay, and Dr. Rae on the same coasts, 1,030 miles, making in all, 21,500 miles of coast-line examined, of which 5,780 miles were previously unknown. From this summary the search of the American expeditions is omitted, as well as those of Lady Franklin's private expeditions, all of which would add greatly to the total. Admiral Sir F. L. M'Clintock has estimated the amount of money expended by the British government on Arctic research, including the outfitting of the *Erebus* and *Terror,* at £272,000, and on the relief and search expeditions, £675,000; to this must be added the money subscribed for private expeditions, amounting to £35,000. The expeditions fitted out in the United States, mostly by private subscriptions, cost over $250,000. Admiral M'Clintock has further estimated that the number of miles traversed by sled expeditions only, over ice and land, is about 43,000 miles. His views as regards the economic and scientific value of the Arctic explorations are as follows: 'The benefits, doubtless, have been very great; to whaling commerce it has opened up all to the north and west of Davis strait and Hudson strait; also to the north of Bering strait. The value of these fisheries alone amounts to very many millions sterling into the pockets of English and American traders. The scientific results are very varied, and ample in almost every department, and peculiarly so in magnetism, meteorology, the tides, geographical discoveries, geology, botany and zoology, as shown by the general advance in each branch. Upon naval impulse the influence has been truly great; we could man an expedition with English naval officers.'

The exploration of Smith sound, the northern inlet to Baffin bay, was commenced during the search for Franklin. In 1852, Captain Inglefield left England, in the screw schooner *Isabel,* with the intention of searching the deep northern inlets of Baffin

bay for traces of Franklin, and with the hope of reaching the open Polar sea through Smith sound. Cape Farewell was sighted on the 30th of July, and Cape York on the 21st of August where a number of natives were seen in the vicinity. At North Omenak native caches of meat and winter clothing were found. On the 26th Cape Alexander, the farthest point seen by Baffin, was passed, with an open sea to the northward. On the 27th he reached latitude 78° 21′ N. one hundred and forty miles beyond any previous navigator. He was forced by a strong northerly gale and low temperature to retreat south, and on his way entered Jones sound, which he explored to latitude 76° 11′ N. and longitude 84° 10′ W. He then entered Lancaster sound, and visited Beechey island, after which, turning homeward, he did not cross the Arctic circle until the 12th of October.

In 1853, Dr. Elisha Kent Kane left New York in the brig *Advance,* fitted out by Henry Grinnell and George Peabody, to assist in the search for Franklin. The *Advance* entered Smith sound on the 7th of August, and, after considerable danger and trouble with ice, was moored in Rensselaer bay, from which she never emerged. This wintering place was about 120 miles north of any previously attained, being in latitude 78° 38′ and longitude 70° 40′. Kane confined his explorations to the Greenland side of the sound, and personally reached the southern edge of the great Humboldt glacier, while Dr. Hayes, surgeon to Kane, crossed Kane basin to the neighbourhood of Cape Fraser, and William Morton, on the Greenland coast, passed the Humboldt glacier and attained latitude 80° 35′ in the vicinity of Cape Constitution, where from an elevation of 500 feet he saw open water in Kennedy channel extending to the north as far as the eye could reach. In July, 1854, the ice being still firm, Kane attempted to reach Beechey island, where he knew that assistance could be obtained, but had to return before reaching Cape Parry. At the end of August, Hayes and

eight others of the crew left the ship with the intention of reaching the Danish settlement of Upernivik; they returned in December, nearly dead of starvation and cold. The vessel was formally abandoned on the 20th of May following, and on the 17th of June the boats were launched in open water near Cape Alexander. Cape York was doubled on the 21st of July, and the greatly reduced party reached Upernivik on the 6th of August.

Dr. I. I. Hayes was the next to attempt to reach the supposed open sea, by way of Smith sound. He left Boston, in the schooner *United States,* on the 7th of July, 1860, and on the 12th of August reached Upernivik, where he added six natives to his crew, bringing the total number up to twenty-one. Meeting with a succession of northerly gales off Cape Alexander, Hayes was obliged to winter south of Littleton island, in Foulke fiord, in latitude 78° 18′ N. He first tried to explore the Greenland coast, but was obliged to abandon the attempt on account of the very rough ice. He then determined to cross Kane basin and follow the west coast northward. Thirty-eight days were occupied in crossing the seventy miles between the ship and Cape Hawkes, after which he claims that six days' travel brought him to Cape Lieber, situated 170 miles beyond Cape Hawkes; this is evidently a mistake. The ship was released on the 10th of July, and the passage north being barred by solid ice, Hayes crossed to the west side, and explored the coast southward from Cape Sabine to Cape Isabella before returning home. He was thus making good the claim of being the first white man to tread the shores of Ellesmere island.

The next expedition to Smith sound was commanded by Charles F. Hall, in the *Polaris.* Hall had previously spent two years among the natives at Frobisher bay, the charting of which is due to his efforts. On his return from this first trip he went, in a whaler, to Roes Welcome, where he again lived with and like the natives, in an attempt to recover the logs and other

records of the *Erebus* and *Terror*. He remained in the country for four winters before he succeeded in reaching the southern shores of King William island ; he was unsuccessful in his quest. Hall throughout his journeys kept a voluminous journal; he took meteorological observations and observations for his position. His instruments appear to have been not of the best, and Hall seems to have had a great faith in the statements of the natives, a faith that was often abused; in consequence, much of his information from that source is quite unreliable.

To return to the *Polaris* expedition, fitted out by the United States government, with the object of reaching the North Pole. She left New York on the 29th of June, 1871, with a crew of twenty-three, which was increased by ten Greenlanders. Melville bay was crossed in thirty-four hours, and Smith sound being free of ice, an almost uninterrupted passage was made through Kane basin and Kennedy channel, so that the Polar ocean was reached on the 31st of August in latitude 82° 11′, to the northwest of Repulse harbour, where heavy, ancient, arctic ice stopped further progress. Returning southward, the *Polaris* went into winter quarters at Thank God harbour. Hall, in October, reached Cape Brevoort, but died suddenly shortly after his return, and this calamity put a stop to further efforts to reach the Pole. Some explorations were made in the early spring before it was decided to return home. On the way south the ship was caught in the ice in Kennedy channel, on the 14th of August, and remained fast in the pack until the 15th of October, when a furious gale broke up the pack, in sight of Northumberland island, after nearly destroying her in the process of disruption. When this occurred several of the party who were on the ice landing stores were left, and drifted southward 1,500 miles on the ice, being rescued by the *Tigress,* off the coast of Labrador, on the 30th of April, 1872. The vessel was beached at Life Boat cove, and the remainder of the crew passed the winter in safety in a house built from the wreck.

During the winter two boats were built, in which the party started to retreat on Upernivik, but were fortunately rescued by a relief steamer in the vicinity of Cape York.

The British Government, in 1875, fitted out an expedition with Captain George Nares in command of the *Alert,* and Captain Stephenson, second in command, on the *Discovery,* while the complete crews numbered one hundred and thirty officers and men, with three native dog-drivers. The instructions, which were to proceed up Smith sound, indicated that the primary object of the expedition was to attain the highest northern latitude, and, if possible, the North Pole, including explorations to the adjacent coasts from winter quarters. The ships left England on the 29th of May, and Cape York was reached on the 25th of July, after very little trouble with the ice. Here the first of a series of caches of provisions was established, to provide for the safety of the crews in case they were obliged to abandon the ships and retreat southward over the ice. These caches were not used, and being left for future explorations were the means of preserving life in the survivors of Greely's party some years later.

From Cape York the passage northward was a constant struggle with immense floes of heavy ice, so that it was the 25th of August before the *Discovery* anchored for the winter in Discovery harbour. The *Alert* pushed on, and reached Floeberg beach, in latitude 82° 25′ N., and longitude 61° 30′ W., where further progress was barred by the heavy ancient ice of the Polar sea, to which Nares has given the name paleocrystic, to distinguish it from the ice of more southern waters, which is formed annually. Here the *Alert* was moored for the winter, exposed to the crushing action and movement of these solid floes, in a latitude far north of that before attained by any ship. Depôts of provisions were established during the autumn by sledging parties for use in the following spring. On the 3rd of April seven sleds, manned by fifty-three men and officers, left

the *Alert* for northern explorations. One party, under Commander Markham, was to push northward over the frozen ocean; the other, under Lieutenant Aldrich, to explore the north coast of Grinnell land. Markham, after great toil and hardships, hauling heavy sledges and boats over exceedingly rough ice, and with five of his eighteen men helpless from the effects of scurvy, succeeded in reaching a point on the ice in latitude 83° 20′ 26″, the farthest north to that date. The health of the men became worse on the return journey, and if Lieutenant Parr had not, by a forced march of twenty-four hours, reached the ship for assistance, all would probably have been lost; as it was, one died and eleven others had to be dragged to the ship.

Lieutenant Aldrich surveyed two hundred and twenty miles of new coast, reaching, on the 18th of May, Point Albert, in 82° 16′, and 85° 33′ W. His party, also attacked by scurvy, would not have reached the ship without assistance.

Exploring parties were, at the same time, in the field from the *Discovery*. Lieutenant Archer explored Franklin sound and reached the head of Archer fiord. Lieutenant Beaumont left the ship with two sleds, and, after first visiting the *Alert*, crossed Robeson channel to Repulse harbour, on the coast of Greenland. He succeeded in reaching with one man, the eastern side of Sherard Osborne fiord, in 82° 20′ N. and 50° 45′ W., on the 20th of May. The return was made under distressing circumstances; only Beaumont and one man were free from scurvy when Repulse harbour was reached. The ice in Robeson channel was too rotten to cross with his crew of invalids, and but for the timely arrival of a relief party all would have perished. Two men died, and only with great difficulty did the remainder reach the ship. Owing to the scurvy, Captain Nares wisely determined to return home. The disease had attacked almost every man on the ships outside the officers, but it is a mystery why it should have played such ravages on an

expedition fitted out and provisioned with all possible precautions against the disease; the only explanation given is that the men were over-worked, slept in damp clothes, and were regularly served with a liberal ration of spirits. The *Alert* left Floeberg beach on the 31st of July, and on the 9th of September both vessels safely reached the open sea, and recrossed the Arctic circle on the 4th of October.

In 1881 the United States government determined to establish a meteorological station in connection with the international polar stations in the region of Smith sound. Congress voted an appropriation of $25,000 for this expedition, a sum ridiculously small, as only $6,000 remained after paying for the transport of the party to their destination. The expedition was under the command of Lieutenant A. W. Greely, and was composed of officers and men from the United States army, none of whom had had previous experience in Arctic work. The party, numbering twenty-six, sailed from St. John's, Newfoundland, in the steam sealer *Proteus,* on the 4th of July, 1881. At Upernivik two Eskimo dog-drivers were added to their number. Little trouble was experienced from the ice until the ship reached Discovery bay, where the station was to be located, and after a short delay the party was landed on the 11th of August. Two men found to be physically unfit were sent home. A house was soon erected, and the observation work carried on regularly during the time that the expedition remained there. In the spring of 1882 several sled journeys were made, the most important being that of Lieutenant Lockwood, who crossed Kennedy channel, and passing northeastward along the coast of Greenland pushed beyond the farthest point reached by Lieutenant Beaumont, and succeeded in reaching latitude 83° 23′ N., the highest attained at that time. The *Neptune* attempted to relieve them during the summer of 1882, but found Smith sound blocked with ice. The second autumn and spring were spent in making explorations, chiefly in Ellesmere

island. Lockwood attempted to pass his previous record, but was prevented by the loose ice and the rugged mountains along the northern coast. As no relief ship arrived and parts of the supplies were running short, a retreat was decided upon, and the party started south in a steam launch and two boats, on the 11th of August. Great trouble was experienced in the heavy ice, and they were obliged to abandon their boats on the 10th of September, after having been beset by the ice for two weeks. Land was reached at Cape Sabine on the 29th of September, where a poor shelter of stones and canvas was erected, in which the party passed the winter. Their provisions comprised the remainder of the food taken with them, and a small quantity landed from the *Proteus* after that vessel sank from an ice nip while trying to reach Greely a few weeks earlier in the season. The bulk of their provisions was obtained from the caches left by Nares in 1875. Exposure to the weather had nearly ruined everything left in the caches, but their contents, even in this shape, were of great assistance to these famished men; without them all would have succumbed; as it was, only seven survived the hardships and starvation, when the rescue steamer arrived on the 22nd of June, 1883.

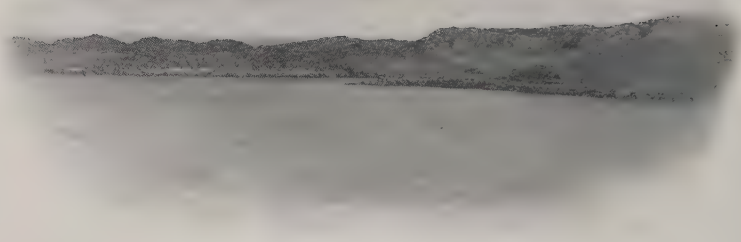
The next Arctic work was the crossing of the Greenland ice-cap, in 1893, by Nansen, who landed on the eastern side, and with a few companions succeeded in passing over the immense fields of ice and snow, coming out on the coast of the western side to the southward of Disko.

Lieutenant R. E. Peary, United States navy, spent eight winters in the regions about Smith sound. During these years none of the ships engaged to take supplies to him were able to penetrate more than the southern portion of Smith sound, and consequently Peary had to haul all his provisions and outfit over the very rough ice in dog-sleds two hundred miles before he arrived at the original starting point of Beaumont and Lockwood. This was a handicap of the severest des-

cription, and Peary deserves the greatest credit for the manful way in which he overcame it, and succeeded in not only crossing the ice-cap of the northern part of Greenland, but also in tracing its northern outline far to the eastward, and so establishing the certainty of the island character of that supposed peninsula.

The last of the expeditions to the Smith sound region was that headed by Captain Sverdrup, in the famous *Fram*. This expedition started with the intention of exploring the northern part of Greenland, but found Smith sound blocked with ice, and the *Fram* was obliged to pass the winter of 1898-99 at Cape Sabine, where Greely's party passed their last winter. In the spring, parties from the ship explored Hayes sound, and crossed Ellesmere island to its west coast. In 1899 Smith sound continued closed, and Sverdrup returned south with the intention of exploring Jones sound. Taking the *Fram* up that channel, he went into the second winter quarters on its north side, in a small fiord on the south coast of Ellesmere island. During the following spring two long sled journeys were made to the north and west, occupying seventy-six and ninety days respectively. The *Fram* broke out of winter quarters on the 9th of August, 1901, and proceeding westward was beset off the north coast of Grinnell peninsula until the middle of September, when she was again released, and reached winter quarters in Belcher channel at the western end of Jones sound. In the spring of 1902 two long journeys were again undertaken by Sverdrup and Isacksen, involving important discoveries. The *Fram* could not be released, and a fourth winter had to be faced. Sverdrup made his longest and most important journey in the spring of 1902, while his companions were making minor trips. On the 6th of August the *Fram* was released, and returned to Norway, after having completed the last great and important work that remained to be done in the Arctics, thus finishing the work begun three centuries ago. The principal achievements were the

mapping of Jones sound and the western side of Ellesmere island, the discovery of a large island lying on the west side of Ellesmere island, and two other large islands in latitude 79°, extending westward to longitude 106° W., which is that of the eastern side of Melville island, while North Cornwall and Findlay islands were seen to the south. To the westward and northward no signs of land were seen, and the ancient Arctic ice was found pressing on the coasts of these new northern islands, so that the line of drift pressure can now be traced from Bering sea to the east coast of Greenland.



Frenchman Cove, Cyrus Field Bay.

CHAPTER V.

THE ARCTIC ISLANDS.

Little is known of the interior of even the more southerly of the Arctic islands. Up to the present time exploration has been largely confined to their coasts, with only a few isolated lines run across their interiors. In this way, however, sufficient knowledge has been obtained to give a general idea of the geography, which will probably be greatly modified when future explorations have given more information.

Thanks to the work done by the numerous search parties for the unfortunate Franklin and his companions, the coast lines

of many of even the most northern islands have been thoroughly explored. The work left undone by these parties has since been practically finished by the British expedition of 1875, and by the work of Greely, Peary and Sverdrup.

The physical features of the coasts visited by the *Neptune* have been described in detail in the narrative of the voyage, and need not be repeated here. All other information concerning the geography of these northern lands has been obtained from the printed records of earlier Arctic travellers, and is here used to give some general idea of the extent and physical condition of these islands.

The islands of the Arctic archipelago extend from the north side of Hudson bay and Hudson strait, in 62° N. latitude to 83° N. latitude, a distance of 1,500 miles. Their greatest extension westward is along the 73rd parallel, from the west side of Baffin bay to 125° W. longitude, a distance of 500 miles.

The islands have, for convenience, been divided into four natural groups, as follows:—

Group I.—The islands situated in the northern parts of Hudson bay and Hudson strait. These include the great island of Southampton, together with the smaller islands of Coats, Mansfield, Nottingham, Salisbury, Charles, Akpatok, Resolution and many other small ones still unnamed.

Group II.—Includes the islands lying between Hudson bay and Hudson strait, on the south, and Lancaster sound on the north, the western boundary of the group being Prince Regent inlet. The largest of all the islands, Baffin, belongs to this group. The only other island of considerable size is Bylot, while the remainder are small and fringe these two large islands.

Group III.—This contains the islands lying west of Prince Regent inlet and south of Lancaster sound, and its western continuation, Barrow strait. These islands are almost inaccessible,

as they lie to the west and south of the ice-covered waters of Lancaster sound, the only channel by which they may be reached from the eastward; while the western islands of the group can only be reached by passing through the Arctic ocean from Bering strait, a long distance to the eastward of them. They are comprised of Banks, Victoria, Prince of Wales, North Somerset and King William islands.

Group IV.—The islands north of Lancaster sound and Barrow strait. These include the great islands of Ellesmere and North Devon, whose eastern sides front on Baffin bay and Smith sound; the Parry islands—Cornwallis, Bathurst, Byam Martin, Melville, Eglinton and Prince Patrick—all on the north side of Barrow strait; the Sverdrup islands—Axel Heiberg, Ellef Ringnes, Amund Ringnes, King Christian and North Cornwall—situated to the west of Ellesmere and to the north of the Parry islands.

The following is a list of the islands of the archipelago, having an area greater than 500 square miles:—

		Area square miles.
Group I.	Southampton	19,100
Group II.	Baffin	211,000
	Bylot	5,100
Group III.	Banks	26,400
	Victoria	74,400
	Prince of Wales	14,000
	North Somerset	9,000
	King William	6,200
Group IV.	Ellesmere	76,600
	North Devon	21,900
	Bathurst	7,000
	Cornwallis	2,700
	Eglinton	700
	Prince Patrick	7,100
	Melville	16,200
	Axel Heiberg	13,200

	Area square miles.
Ellef Ringnes	4,800
Amund Ringnes	2,200
King Christian	2,600
North Cornwall	600
Total area	520,800

The configuration and the physical features of the islands depend upon the character of the rocks that form them; in consequence, a brief description of the geology of these northern regions is here given.

Granites, gneisses and other crystalline rocks, very similar to those forming the Archæan system of more southern regions, occupy the eastern shores of the great islands fronting on Baffin bay and Davis strait, from Smith sound to Hudson strait. On Ellesmere island these rocks form a wide band down the east side from the neighbourhood of Cape Sabine to Jones sound, where the western boundary is upwards of fifty miles from the mouth of the sound. They occupy the eastern part of North Devon, reaching, on its south side, some seventy miles up Lancaster sound. The whole of Bylot island and that part of northern Baffin island to the eastward of Admiralty inlet is formed of these rocks. The great island of Baffin has upwards of three-quarters of its area underlain by Archæan granites and other crystalline rocks, while the eastern side of Southampton belongs to that formation which is also found at Salisbury, Nottingham and Charles islands of Group I.

To the westward of this wide rim of Archæan rocks is a great basin which has been filled with deposits of limestone, sandstone and other bedded rocks belonging to the Palæozoic or middle formations of the earth's crust. These rocks extend upward from the Silurian to the Carboniferous.

The lower rocks, consisting largely of limestones, are the most widely distributed. They extend southward and westward far beyond the limits included in this report. The rocks newer

than these Silurian limestones are not found south of Lancaster sound and Barrow strait, except on the northern part of Banks island at the extreme west of the archipelago. These rocks of Devonian and Carboniferous age occupy the Parry islands and the western and northern parts of Ellesmere, and in many places contain good deposits of coal.

A yet newer series of rocks belonging to the Mesozoic are found along the western edge of Ellesmere and on the Sverdrup islands. Isolated patches of later Tertiary age probably also occur along the northern and eastern coasts of Baffin island, and are of importance in that they are often associated with deposits of lignite coal. Small areas of this age have been found in the Parry islands and on the western part of Banks island.

On these northern islands the country underlain by the crystalline Archæan rocks is very similar in physical character to like areas of more southern regions. Where these rocks occur, the coast is usually greatly broken by irregularly shaped bays and headlands. The shores are often fringed with rocky islands, and the adjacent sea-bottom is liable to be very uneven. The land, as a rule, rises rapidly from the coast into an uneven plateau or tableland, whose general level is broken by ridges of rounded hills which seldom rise more than a few hundred feet above the general level. The elevation of the tableland varies from a few hundred feet to an extreme height of nearly five thousand feet.

In the northern parts the surface of this Archæan tableland is usually covered with a thick ice-cap, through which only the loftier hills protrude. The valleys leading down to the coast from the ice-cap are filled with large glaciers which project into the bays, where they discharge numerous icebergs. As the ice-cap becomes thinner in the more southern parts the glaciers become less active, and generally terminate without reaching the sea, and consequently no icebergs are formed from them.

The country, formed of the limestones and other Palæozoic rocks, differs in its physical character from that already described. On the northern islands, where these rocks attain a considerable thickness, the land rises in abrupt cliffs directly from the sea. The summits of these cliffs vary in elevation from 1,000 to 3,000 feet, while the country behind is a tableland rising in steps inland, the front of each step being a cliff usually of much less thickness than the initial one by which the land rises from the sea. In the more northern islands the higher portions of these tablelands support ice-caps generally much thinner than those covering the adjoining Archæan tablelands. The coasts composed of these flat-bedded limestones are deeply indented by narrow bays or fiords in the valleys of the more important streams; each small stream and rill flowing off the land has left its sculptured mark upon the cliffs, so that the whole resembles, on a great scale, the banks of a stream cut into a deep deposit of clay. This minute sculpturing of the rocks points to their having been elevated above the sea for a very long period, during which time the streams were actively at work cutting their valleys down to the sea-level.

These high abrupt cliffs are characteristic of the islands on both sides of Lancaster sound and to the northward of it.

The limestone islands of Hudson bay and that portion of southwest Baffin underlain by these rocks are very low and flat, with shallow water extending several miles from their shores.

Those northern islands, wholly or in part formed of the Mesozoic rocks, are characterized by low shores and no great elevation inland. At Ponds inlet, where an area of Tertiary deposits occurs, the country overlying it forms a wide plain deeply cut into by the streams that drain it.

ISLANDS OF GROUP I.

The islands of Hudson bay and Hudson strait are, naturally, divided into two sections by their physical characters, the first composed of those formed from the crystalline Archæan rocks, the second of the low islands of limestone. The first division includes Resolution, Big, Salisbury, Charles and Nottingham islands, together with many smaller ones along the north side of Hudson strait. These islands are physically alike, being moderately high and having ragged shore lines.

Resolution island lies on the north side of the eastern entrance to Hudson strait. It is nearly forty miles long, and averages twenty-five miles in breadth. The general elevation of the interior is under five hundred feet, and the land appears to rise quickly from the shores. The island is fringed by many rocky islets, and a number of good harbours are said to occur on all sides of it, but owing to the strong currents about the coast it has been rarely visited, except by ships caught in the ice.

Big island lies close to the north shore of the strait, and about one hundred and forty miles beyond its eastern entrance. The island is triangular in shape; the longest side, parallel to the mainland, has a length of thirty miles, the other two sides being each about twenty-five miles long. In physical character and elevation it is very like Resolution.

Charles is a narrow island some twenty-five miles long, situated in the southern part of the strait, being distant about twenty-five miles from the south side; its west end is ninety miles from Cape Wolstenholme at the western end of the strait. The eastern half of the island is high and rugged, and is connected with the lower rocky western end by a narrow sandy neck. The highest part of the western end does not reach an altitude of two hundred feet, and terminates in a long

low point with shallow water extending from it for several miles.

Nottingham and Salisbury islands lie in the western entrance to Hudson strait. Their longer axis lies northwest and southeast. Nottingham is the more southward, and is about thirty-five miles long and averages about ten miles across. Salisbury lies to the northeast of Nottingham, and is separated from it by a deep channel about fifteen miles wide. The northern island is the larger, being nearly forty miles long and averaging fifteen miles across. Both are high and rugged, with a number of bays affording good harbours, especially at the southeast and northwest ends. The general altitude of these islands is nearly five hundred feet.

The second division of the islands of Group I. includes the large island of Southampton, together with Coats, Mansfield and Akpatok islands.

Southampton is situated in the northern part of Hudson bay, which it divides into Fox channel on its east side and Roes Welcome on the other side, being separated from the mainland at its north end by the narrow Frozen strait. The island attains its greatest length from north to south, covering three degrees of latitude, or a distance of two hundred and ten miles. Its greatest breadth of two hundred miles is across its southern part; its eastern side trends northwest, and its western shore lies north and south, so that the shape is practically a triangle, having an area of 19,100 square miles. The greater part of the island is occupied by flat-bedded limestone, causing the southern and western shores to be generally low and flat, with a margin of shallow water extending several miles from the land. Along the eastern side a band of crystalline rocks extends from Seahorse point to the north end of the island, and this forms much higher land with bolder water adjoining than is found elsewhere.

Coats island lies directly south of Southampton, from which it is separated by Evans and Fisher straits. With the exception of a ridge of moderately high land crossing the island diagonally at its eastern end, the island is low and flat, having no elevation of over a hundred feet. Its longer axis of one hundred miles lies nearly northeast and southwest, while its greatest breadth is about twenty-five miles.

Mansfield island, being wholly composed of limestone, is everywhere low and flat, with no elevations greatly exceeding a hundred feet. The island, with a length of seventy-five miles, lies parallel to and about that distance from the east coast of Hudson bay, its north end being on a line with Cape Wolstenholme.

Akpatok island, included in this division on account of its being of limestone formation, lies in the mouth of Ungava bay of Hudson strait. It is nearly fifty miles long, and lies diagonally to the west coast of the bay, so that its southern end is about thirty miles from the mouth of Payne river, while the north end is nearly twice that distance from Cape Hopes Advance. The limestone forming the island being more solid than that of the western islands, the shore line is bolder and more broken, the island rising in low cliffs directly from the sea, and having a general elevation considerably higher than that of those just described.

ISLANDS OF GROUP II.

Baffin island, with its area of 211,000 square miles, is the largest and probably the most important and valuable of the Arctic islands. Its southern shores form the north side of Hudson strait; its eastern side extends from Hudson strait to Lancaster sound, or from 61° N. latitude to 74° N. latitude, a distance of over 850 miles fronting on Davis strait and Baffin bay. The island is bounded on the north by Lancaster sound

HEAD OF CYRUS FIELD BAY, BAFFIN ISLAND.

PUBLIC LIBRARY

and on the east by Prince Regent inlet, Fury and Hecla strait and Fox channel. As Archæan crystalline rocks occupy the greater part of the island, the Silurian limestones being almost confined to the western side, the coast is very irregular, and is indented by deep bays, especially along the east and north sides. The larger ones on the eastern side, passing northward, are Frobisher bay, Cumberland gulf, Exeter sound, Home bay, Clyde river, Scott inlet, and Ponds inlet, together with many more of considerable size and length. The principal indentations of the northern coast are the long narrow bays named Navy Board and Admiralty inlets. Much of the western coast is at present unexplored, but enough is known of it to say that no very long bays are to be found there.

Islands are very numerous along those parts of the coast formed of the crystalline rocks, and these vary greatly in size.

The coast between Ponds inlet and Cape Dier to the northward of Cumberland gulf has never been properly surveyed, and the present charts of this part are, according to the whaling captains, quite erroneous.

The eastern coast of Baffin island is generally high and rocky. The land rises quickly from the sea, often in abrupt cliffs, to elevations of a thousand feet or more, after which the upward slope is more gentle as the land rises towards the interior tableland. The general elevation of the tableland, to the south of Cumberland gulf, ranges from 2,000 to 3,000 feet, while to the northward this wide coastal area is much higher, reaching a general elevation of 5,000 feet, with hills rising above that perhaps one or two thousand feet higher. Inland to the south of Ponds inlet the general elevation does not appear to exceed 3,000 feet, and to the westward is considerably lower. The land fronting on Lancaster sound, between Navy Board and Admiralty inlets, is very rough and broken, and rises in the interior to perhaps a general elevation of 2,000 feet. The

remainder of this northern coast between Admiralty inlet and Prince Regent inlet is formed of flat-bedded limestone, and rises in steep cliffs about a thousand feet high to a comparatively flat plateau. This plateau with its cliffs continues down the east side of Prince Regent inlet nearly to Fury and Hecla strait, the land gradually becoming lower towards the south. The eastern side of Fox channel is as yet unexplored, and all information concerning it has been obtained from the Eskimos. They describe the coast as generally low, and much the same in character as that of the limestone islands of Hudson bay. The limestone country terminates some distance north of King cape, which marks the western limit of Hudson strait on its north side, and the coast is again formed of crystalline rock, with its characteristic broken outline and fringe of islands. The northern shores of Hudson strait along its western half although bold are not high, and the interior probably does not reach a general elevation of 1,000 feet. To the eastward of Big island the coast becomes higher, and the land rises slowly inland to elevations of 2,000 to 3,000 feet.

The highlands to the northward of Cumberland gulf, along the east side of the island, appear to be covered with an ice-cap, from which glaciers flow down the valleys leading to the many bays on this coast. These glaciers are neither as heavy nor as active as those of the islands north of Lancaster sound, and only rarely do they project into the sea and discharge icebergs. The lower lands adjoining the coast are usually free of snow during the summer. The ice-cap, according to the natives, does not extend far inland, the interior being practically free of snow during the summer months. About Cumberland gulf and to the southward the highlands are partly snow-covered, but the patches are detached, and there are no glaciers sufficiently large to discharge into the sea. The Grinnell glacier is an ice-cap covering the summit of the highland between Frobisher bay and Hudson strait. It is said to discharge by one small glacier into

Shore of Cumberland Gulf From Blacklead Island.

a fiord on the south side of Frobisher bay, but the ice from it rarely breaks off as icebergs.

The northern land between Admiralty and Navy Board inlets is ice-covered, with glaciers filling its seaward valleys, and with the separating rocky ridges rising dark and forbidding from the general field of white. A thin ice-cap covers the northern part of the limestone plateau on the east side of Prince Regent inlet.

The western interior of the northern half of Baffin island is described by the Eskimos as a rough plain, probably less than 1,000 feet in elevation, diversified by rolling hills with numerous lakes in the valleys between. This country is well covered with an Arctic vegetation which provides food for large bands of barren-ground caribou.

There are two large lakes in the lower country of the south-western part of the island called Nettilling and Amadjuak; both are upwards of a hundred miles long, and the low lands surrounding them are the favourite feeding grounds for large bands of barren-ground caribou. The natives from Cumberland gulf, Frobisher bay and the north shores of Hudson strait resort to the shores of these lakes annually to slaughter large numbers of these animals for food and for their skins, which are used for winter clothing and bedding.

Bylot island lies to the northeast of Baffin, being separated from the latter by the Ponds and Navy Board inlets. It is roughly circular in outline, with a diameter of nearly ninety miles. In physical character it closely resembles the north-eastern part of Baffin, already described, being formed from crystalline rocks. The general elevation of the interior ranges from 2,000 to 3,000 feet, and the coastal highlands are covered with an ice-cap which extends ten or fifteen miles inland, the interior, according to the Eskimos, being free of snow during the summer. The ice-rim feeds numerous glaciers, some of which discharge bergs.

ISLANDS OF GROUP III.

As has been already stated, the islands of this group can only be reached with considerable difficulty on account of their position. Little is known of them beyond the outline of their shores, and even these have not been fully traced in the case of the more western islands.

North Somerset, separated from the northern part of Baffin by Prince Regent inlet, is the best known of the group, and its northern and eastern shores have long been resorts of the whalers in their search for the valuable Right whale in the adjoining waters. The less valuable white whales are often abundant along these shores, and are taken by the whalers when the larger whales cannot be obtained. The greatest length of this island is from north to south, being 140 miles, while its extreme breadth in the northern part is about a hundred miles. In shape it somewhat resembles a ham with the shank to the southward, where the narrow Bellot strait separates it from Boothia peninsula, a northern extension of the continent, remarkable for containing the North Magnetic Pole within its area. The northern coast of North Somerset is formed of limestone cliffs; these are lower and less abrupt than on the northern Baffin coast, while the bays indenting them are wider and not so long as is usual on such coasts. Along the eastern side the cliffs rise nearly 1,000 feet directly from the sea. To the south, along this shore, the cliffs gradually decline, until the low lands about Creswell bay are passed, when the country again becomes high and the coast bold. The western side of the island, facing on Peel sound, is occupied by a wide strip of Archæan rocks, and the physical character corresponds to that of other like areas. This coast never rises above the 1,000 feet contour, and towards the south is considerably lower. There does not appear to be any continuous ice-cap upon North Somerset, and the glacial conditions are confined to isolated snow patches, with

small glaciers in some of the larger valleys. These glaciers do not discharge icebergs.

Prince of Wales island is separated from North Somerset by the narrow channel of Peel sound and Franklin strait. It is irregular in shape, being broken by a number of large bays. The greatest length, 175 miles, is from north to south, while the broadest part is 125 miles across. The northeast corner is occupied by crystalline rocks, the remainder being of limestone. In no place does the elevation of the interior plain exceed 500 feet.

King William island lies to the southward of Prince of Wales island in an angle formed by the northern coast of the continent and Boothia peninsula. It is described as a low barren island of limestone, of triangular shape, with a base seventy miles long on the northwest side, the other sides having each a length of nearly one hundred miles. The island is noted for the discovery on its shores of the bodies of several of the ill-fated members of Franklin's expedition, together with the record of Franklin's death and the crushing of the ships in the heavy ice off the northwest coast of the island.

Victoria island is the third largest of the Arctic archipelago, its area being 74,400 square miles. Only the western and southern shores of this great island have been explored, and practically nothing is known of its interior. It is 450 miles long from northwest to southeast, and is over 300 miles across in the widest part. With the exception of a small area in the northwest, it is formed of Silurian limestone. The island is generally level, the greater part of it being well below an elevation of 500 feet.

Banks island is the most western of this group; it is separated from Victoria by the narrow Prince of Wales strait. Its greatest length from northeast to southwest is about 250 miles, while the average breadth is about 120 miles. The island is formed largely of the softer rocks of the Carboniferous, and is

considerably higher than those to the eastward, the greater part of the interior being above 1,000 feet, while in the southern part the plateau reaches an altitude of 3,000 feet. The soil from the Carboniferous rocks being richer and deeper than that on the bare limestone islands, supports a good growth of arctic vegetation, and in consequence the valleys leading to the coast are the feeding grounds of large bands of musk-oxen, barren-ground caribou and arctic hares, this abundance of animal life being in marked contrast to that on the barren limestone islands. The lowlands bordering the sea in the northwest part of the island are formed of Miocene-Tertiary deposits, containing numerous trees allied to those now covering the wooded northern parts of the mainland, far to the southward. The presence of these trees shows that, in the period before the Ice-age, the climate of these northern islands must have been much warmer than at present.

ISLANDS OF GROUP IV.

The island of Ellesmere is only second in size to Baffin island, and is remarkable for its north end extending to beyond the eighty-third parallel of N. latitude, or to within 500 miles of the North Pole. Its length from north to south covers nearly seven degrees of latitude, or approximately 500 miles; its greatest breadth across the northern part exceeds 200 miles. Being deeply indented by large bays both on its east and west sides, its outline is quite irregular. Smith sound, and its northern extensions Kennedy and Robeson channels, separate the eastern shores of Ellesmere from the northern part of Greenland.

The general elevation of the island is high, and probably exceeds 2,500 feet. In the northern part the United States mountains are upwards of 4,000 feet high, while isolated peaks of this range reach a height of almost 5,000 feet. It is remarkable that this high northern land is not covered with a

continuous ice-cap, but this is probably due to the small precipitation of moisture derived from the ice-covered northern seas. The first large ice-cap is situated in the interior, to the south of 81° N. latitude, and extends southward to 79° N. latitude, where an area of lower lands occurs near the junction of the Palæozoic rocks of the north and the Archæan of the southeast. The southeastern quarter of the island occupied by crystalline rocks has a general elevation of 3,000 feet or over, and is covered by a great ice-cap, with numerous glaciers discharging from it into the eastern bays. A great thickness of Palæozoic extending upwards from the Silurian to the Carboniferous occupies the southwest quarter of the island, where the rocks rise abruptly to a tableland with an elevation of nearly 3,000 feet. The cliffs of the southern coast are indented by many long narrow fiords. Along the western side of the island is a wide margin of softer Mesozoic rocks which form low plains extending from the seashore several miles inland to the base of the high cliffs of older rocks. These plains are covered with arctic vegetation. Musk-oxen, barren-ground caribou and arctic hares are found there in large numbers, along with geese and other aquatic birds.

North Devon island lies to the south of Ellesmere, being separated from it by Jones sound; Lancaster sound bounds it on the south. The island, in shape, somewhat resembles a swimming bird with the head to the northwest and the body east and west. The body is about 220 miles long and averages seventy-five miles across. Grinnell peninsula forms the head, the neck being very irregular, and nearly pierced through by several long bays; the length of head and neck is a hundred miles. The eastern third of the island is composed of crystalline rocks, and rises to an irregular ice-clad tableland some 3,000 feet in altitude. The rise to the interior is somewhat abrupt, and the landscape, seen from the sea, shows an interior ice-cap in the distance, with bare rocky hills rising irregularly

above the slopes of the glaciers flowing down the valleys to the sea. The western part of the island is formed of limestone, and is a flat tableland cut by deep narrow fiords that extend inland many miles from the coast, and are continued beyond the salt water as the valleys of small rivers. The general elevation of the tableland in the eastern part is nearly 2,000 feet, but this decreases in the westward, so that on the west side the cliffs are below, and in the interior not much above, a thousand feet. The eastern part of this limestone plateau is covered, at least along the coast, by an ice-cap, and a few small glaciers discharge from it directly into the sea. The ice-cap retreats from the fore part of the plateau, and finally disappears before the western shores of the island is reached. There is lower land along the west side of the island, where there is a good growth of arctic plants on which large numbers of musk-oxen feed, together with some barren-ground caribou and arctic hares. The Eskimos from northern parts of Baffin island often cross Lancaster sound to hunt these animals on the western side of North Devon. Walrus and white bears are also plentiful amongst the ice of Wellington channel which separates North Devon from Cornwallis island on the west. Sverdrup found the remains of Eskimo encampments everywhere along the west side of Ellesmere, and speculated as to where the people who made them came from, and also how the Eskimos reached Greenland. The knowledge that the Baffin natives cross to North Devon, and that some of them have joined the arctic highlanders of Smith sound, disposes of these speculations. Their road is across Prince Regent inlet from Baffin to North Somerset, thence across Lancaster sound to the western part of North Devon. The west side of that island is followed north to the narrows of the western part of Jones sound, and a crossing then made to the western side of Ellesmere, where game is plentiful. This coast of plenty would be followed northward to Bay fiord, where the natural pass across Ellesmere would

lead to the fiords of the east side of the island a short distance to the north of Cape Sabine, a place frequently visited by the north Greenland natives.

The Parry islands—Cornwallis, Bathurst, Melville, Eglinton and Prince Patrick—all lie immediately north of the western extension of Lancaster sound—known in parts as Barrow strait, Melville sound and McClure strait. These islands were first discovered by Parry in 1819, but it was the diligent search parties for Franklin that minutely investigated their shores, making them the best known of all the Arctic islands. With the exception of the southern part of Cornwallis, which is formed from Silurian limestone, these islands are composed of softer bedded rocks of the Devonian and Carboniferous. They possess the same physical characteristics, and a general description answers for all. The shore-lines are very broken, being deeply cut by long irregular shaped bays. The land rises in cliffs from 400 feet to 700 feet high, to a plateau broken by many cross ravines, which render travel in the interior difficult. The general level of the interior is under 1,000 feet, and only rarely does it rise above that altitude. In many places coal has been found outcropping in the face of the cliffs of all the islands west of Cornwallis. The practical impossibility of reaching these coal fields precludes them from being counted among the economic resources of Canada.

The Sverdrup islands include Axel Heiberg, Amund Ringes, Ellef Ringes, King Christian and North Cornwall. With the exception of the last named, these islands were discovered by the Norwegian expedition on the *Fram* in 1899-1902. They form a group lying to the west of Ellesmere and to the north of the Parry islands. The largest, Axel Heiberg, lies close to the west side of Ellesmere, and has the same physical characters as those of the western side of the great island; these are high lands in the interior, composed of bedded rocks, and eruptives with low, wide foreshore, where game is plentiful.

The other islands of the group, being formed of the softer rocks of the Mesozoic, are lower in general elevation, and are characterized by wide stretches of low land between the sea and the crumbling cliffs, which rise to the uneven interior plateau, that rarely exceeds 700 feet in elevation.

KENIPITU FROM CHESTERFIELD INLET.

Lower Encampment, Chesterfield Inlet.

CHAPTER VI.

ESKIMOS.

The Eskimos are a circumpolar race, and live in the treeless areas of the northern parts of America and Greenland. Their present southern limit, on the Altantic coast of Labrador, is Hamilton inlet, in 54° N. latitude. From there they inhabit the coast to Hudson strait, and thence along the east coast of Hudson bay, as far south as Cape Jones, at the entrance to James bay. On the west side of Hudson bay their southern limit is much farther north, being at Churchill, in 57° 30′ N. latitude. Northward of that place they are found at intervals

along the entire northern coast of the continent to Alaska. A large number inhabit Baffin island and Nottingham island. The west part of Hudson strait is peopled by a band of these natives, while occasional small parties cross Lancaster sound to North Devon island, and, continuing northward, come in contact with the natives of north Greenland at Smith sound. To the westward of Hudson bay, the Eskimos are mostly confined to the continent, and only make occasional visits to the southern shores of the large islands off the Arctic coast.

A considerable number of Eskimos, forming small communities, inhabit the east coast of Greenland from its southern end up to Melville bay, where a stretch of uninhabited coast occurs between the southern settlements and the home of the arctic highlanders at Smith sound, there forming the most northern permanent settlement of the human race. This is on the east side of the sound, between 74° and 77° N. latitude, or from Cape York to the southern side of the great Humboldt glacier.

At the time of the European discovery of the northern parts of America, the Eskimos extended along the coasts considerably south of their present limits. They occupied the entire Atlantic coast of Labrador, and lived far along the north shore of the Gulf of St. Lawrence. The Eskimos and Indians have always been open enemies. With the advent of the whites, the Indians soon became possessed of firearms, which gave them a great advantage over their northern foes, who were compelled to retreat beyond the tree-limit in the northern regions; here they were safe, as the Indians cannot live without firewood.

The Eskimos continued to inhabit the eastern part of the shore of the gulf of St. Lawrence until about 1630, when they were expelled by the French and Indians. Captain W. Coats, in his notes on Hudson bay, states that in 1748 the Iroquois sent to the Indians of the bay for captive Eskimos, to be used as human sacrifices at some great feast; that the chief of the northern Indians proceeded forthwith on the war-path against

the Eskimos capturing seven and killing thirteen; the captives were sent south to the land of the Iroquois in what is now New York State.

In 1770-72, Samuel Hearne accompanied a band of Chippewyan Indians on a journey from Churchill to the mouth of the Coppermine river. These Indians were only induced to go to the Arctic coast on the chance of killing Eskimos. This they did, by surprising a band busily engaged in fishing at the first fall above the mouth of the river, massacring them all.

This warfare appears to have continued until the Eskimos obtained firearms, when, the conditions becoming equal, the Indians soon found that the pleasure of the Eskimo chase did not compensate for the danger incurred, and, for many years past, active hostilities have ceased, though the two races are still unfriendly, and rarely, or never, intermarry.

Scattered over such a wide area of country, with such poor means of communication, it naturally follows that the Eskimo race is broken up into a number of tribes, distinguished by difference in dialect, and by slight differences in manners and customs. But these are so surprisingly few, considering the conditions, that an Eskimo from the Atlantic coast has no difficulty in conversing with the natives of the west coast of Hudson bay, or with those of Greenland. Their religious beliefs and ceremonies are also wonderfully alike everywhere, and only minor differences are to be seen in their sleds, boats, tents and implements of the chase, these being largely due to the materials used. In fact so close are the essential resemblances that a description of the language, manners and customs of any tribe requires only slight modifications to suit those of the other tribes.

DISTRIBUTION AND NUMBERS OF THE CENTRAL ESKIMOS.

Dr. Franz Boas, who has devoted much attention to the study of the Eskimos, has named those of the eastern half of the con-

tinent the Central Eskimos, to distinguish them from the natives of Greenland and from those of the western Arctic coast and Alaska.

The following divisions are taken from Boas, with such modifications as have been found necessary.

The numbers of the different divisions are in many instances only approximate, as it is exceedingly difficult to arrive at a correct census, even when actually on the ground, owing to the lack of appreciation of the natives of numbers and to their want of interest in such investigations.

THE CENTRAL ESKIMOS.

I. Northern Atlantic coast of Labrador. Population 900 to 1,000.

II. South shore of Hudson strait. Population 400 to 450.
- (a) Kedlingmiut (Cape Chidley) 28.
- (b) Koguangmiut (Ungava bay).
- (c) Okomingmiut (Cape Hopes Advance to Cape Weggs) 115.
- (d) Sedlingmiut (Cape Weggs to Cape Wolstenholme) 40.
- (e) Nuvungmiut (Cape Wolstenholme) 35.

III. East coast of Hudson bay. Population 400 to 450.
- (a) Itivimiut (natives of the mainland).
- (b) Kittoktangmiut (Islands of eastern Hudson bay).

IV. The north shore of Hudson strait. Population 375 to 400.
- (a) Sikosilingmiut (King Charles cape) 150.
- (b) Akolingmiut (Gordon bay to Big island) 125.
- (c) Kuamangmiut (Big island eastward) 80.
- (d) Nottingham island, 30.

V. Davis strait. Population 470.
- (a) Nugumiut (Frobisher bay) 120.
- (b) Okommiut (Cumberland sound) 260.
- (c) Akudnairngmiut (Padli fiord and Home bay) 90.

VI. Northern Baffin island. Population 180.
- (a) Tunungmiut (Ponds inlet) 140.
- (b) Tunurusungmiut (Admiralty inlet) 40.

VII. Northwest coast of Hudson bay. Population 700 to 750.
- (a) Padlimiut (Churchill to Ranken inlet).
- (b) Kenipitumiut (Chesterfield inlet) 140.
- (c) Shaunuktungmiut (Doubaunt river).
- (d) Aivillingmiut (Fullerton to Repulse bay) 138.
- (e) Iglulingmiut (Fox channel) 60.
- (f) Nechillingmiut (westward from Repulse bay to Back river) 450.

From the above table, it will be seen that the total Eskimo population of the eastern half of Arctic America ranges between 3,400 and 3,700 individuals. These people are scattered along the coasts of the mainland and northern islands, while a few live continuously inland to the west of Hudson bay. The present northern limit of permanent settlement of the Eskimos, in eastern Canada, is Lancaster sound and its western extensions, in about 74° N. latitude. Many traces of their habitations have been found on the islands north of Lancaster sound, and far north along the west side of Ellesmere island, but these only represent the temporary quarters of stragglers from the south, who return after a short sojurn in the north.

On the west side of Hudson bay the natives extend southward to the neighbourhood of Churchill, the most southern tribe being the Padlimiut, who inhabit the country northward from Churchill to Ranken inlet, and inland in a northwest direction along the edge of the forest-line to about the latitude of Ranken inlet. Their northern neighbours are the Kenipitumiut, who occupy the territory about Chesterfield inlet and along the rivers tributary to that great bay. The Kenipitumiut are not very numerous, and, according to Captain George Comer, who has made a very careful census of the natives of the west part of Hudson bay, they only number 140 persons. The Aivillingmiut are next northward, and are more confined to the coast than the southern natives; they consequently depend largely on the sea animals for food and clothing, the southern people living mostly

on the barren-ground caribou. The Aivilliks are scattered along the coast from Cape Fullerton to Repulse bay. These are the natives employed by the American whalers to assist in the whaling industry, and who in consequence are more civilized than their neighbours north and south. From long contact with the whalers, there is an admixture of white blood in this tribe, although half-breeds usually die young. The tribe has contracted some of the loathsome diseases of civilization. They at present number 138 persons, and the population now appears to be nearly stationary, though there was a considerable decrease for some years after the whaling vessels first frequented the bay and before the tribe became accustomed to the changes involved.

The Iglulingmiut are a small tribe occupying the east shore of Fox channel, from Repulse bay northward to Fury and Hecla strait, and were the tribe met with and described by Parry, who wintered among them in 1821-22. According to Captain Comer they now number only sixty persons, and are not increasing.

The Nechillingmiut are the most numerous tribe to the westward of Hudson bay, and number about 450 persons. They inhabit the country to the westward of the Igluliks and Aivilliks, extending westward and northward to Back river and the shores and islands of the Arctic sea. The Sinimiut were a small independent tribe, living about the southern shores of Committee bay, but they have now been absorbed into the Nechilliks.

Another small inland tribe is the Shaunuktungmiut, who occupy territory to the southwest of Chesterfield inlet. Little is known about this people, except that they are a small tribe allied to the Kenipitumiut.

Coming to the natives of Baffin island, the Nugumiut tribe inhabit the country about Frobisher bay, and at present have their headquarters at the whaling settlement at Cape Haven, being employed about the station, during the periods of open water, in chasing whales, walrus and seals. Their number is sufficient to man four whaleboats, requiring about twenty able-

Eskimos at Blacklead, Cumberland Gulf.

bodied men, and the total population does not exceed 120 persons.

The natives of Cumberland gulf congregate about the whaling stations of Kekerten and Blacklead, where they are employed for a large part of the year by the whalers. According to the Rev. Mr. Peck, who has now resided several years among them, the total population numbers about 380 souls.

The natives living on the north side of Hudson strait are not numerous, and are split up into three tribes. The Sikosilingmiut live in the inland region of King Charles cape, at the eastern entrance to Fox channel. A number of families from this tribe crossed a few years ago to Nottingham island, and are living there now, having been visited in 1901, when they were found to be without firearms, and were killing deer by chasing them with dogs and shooting them with bow and arrow.

The Akolingmiut tribe reside in the neighbourhood of Big island, in the central part of the north shore of Hudson strait. These are among the oldest known Eskimos and came in contact with the earliest white explorers of Hudson bay. Old writers mention their filthy habits, and the present generation appears to keep up the reputation of their ancestors, as being the most degraded of all the tribes. For a number of years the American whalers had a station on the coast, at Spicer harbour, some miles to the westward of Big island, but it has long been abandoned. At present the Scotch whaling steamer *Active* enters the bay annually, and on arriving at Big island takes on board the entire tribe, after which the ship proceeds to the whaling and walrus grounds of Fox channel and Roes Welcome, where the men are employed in the chase of these animals. A few years ago the firm to which the *Active* belongs established a station on the south side of Southampton, and imported a number of the Big island natives. These natives, being provided with modern rifles, soon killed off or frightened away the deer in the neighbourhood. The old inhabitants of the island

(Sagdlingmiut) being armed only with bow and arrows and spears, were unable to compete with the better armed strangers, and as a result the entire tribe, who numbered 68 souls in 1900, died of starvation and disease during the winter of 1902. The whaling station was abandoned in the summer of 1903, after the death of the original natives, and the great island is now uninhabited except by a few natives from Big island who stay at the old whaling station.

The white men belonging to the whaling station have now been quartered at Repulse bay, and a number of the Big island natives have also been taken there; it is likely, therefore, that they will spread disease and disaster among the Aivilliks and Nechilliks of that region. Some regulation should be made to prevent this unauthorized movement of the natives, or similar wholesale slaughter will again occur.

The Eskimos of the Atlantic coast of Labrador have long been under the direct influence of the Moravian missionaries, and are in consequence much more civilized than the others. The Moravians first arrived on the coast in 1770, and since then have established mission stations along the shores from Hamilton inlet northward to Cape Chidley. Their policy has been to collect the natives into bands about these stations. To accomplish this, they have erected each mission at some place where the natural resources are abundant. The missionaries have kept the Eskimos as free as possible from contact with the floating, white, fishing population, and to do so, have obtained exclusive trading rights from the Newfoundland Government. Their scheme is a sort of parent-hood, by which they supply the natives with food and clothing, taking the product of their hunt in exchange; this scheme seems to work very satisfactorily, the natives being content, while their welfare is attended to without their being pauperized. There is no premium put on laziness and false piety, as is so often the case where the missionary makes a free distribution of food and clothing to the natives.

Then it often happens that the good, industrious hunter, who goes away from the station to provide for his family, receives none of the gifts, which are given to the shiftless individuals who hang about the station in a state of pious poverty. The Moravian Eskimos must provide for themselves by work of one kind or another, and the shiftless ones only receive sufficient to keep life going, without any of its luxuries. These people have all been taught to read and write, there being a number of books printed in the language; the majority of these are of a religious character, but there are some on geography, history and other secular subjects, so that all the natives have a fair knowledge of the outside world. From their long contact with the missionaries, they are devout Christians, have completely lost many of their ancient beliefs and customs, and now conform closely to the manners and customs of civilization.

The natives of Cape Chidley, some half-dozen families, have for a few years been under the care of the Rev. Mr. Stewart. He has had some difficulty instilling the Christian doctrines, and in weaning them from their ancient customs and beliefs.

The Eskimos of Ungava bay and the south shore of Hudson strait are still without knowledge of Christianity, beyond what has been spread by the southern Christian natives. The Eskimos as a rule take kindly to Christianity, and follow its precepts in a manner which shames the average white Christian. All are exceedingly anxious to learn to read the books printed by the Church Missionary Society. These books are printed in a syllabic shorthand, very easy to read, and are supplied from Great Whale river on the east side of Hudson bay, and from Cumberland gulf. A great many Eskimos have never come in contact with the missionaries; notwithstanding this, there are only a few of the Labrador natives who cannot read and write, while the natives of Baffin island are rapidly reaching the same state. Every native who learns to read, and who possesses a book, becomes the teacher of the uninstructed; in this manner

education is spreading rapidly. A good example is found in the natives on the northwest coast of Hudson bay, several of whom have learned to read from the Big island natives on the Scotch whaler, who were in turn instructed by visiting Eskimos from Cumberland gulf.

The Eskimos of the east side of Hudson bay and of the Belcher islands annually come under the teaching of the missionary at Great Whale river, and have to a great extent abandoned the practice of old customs and beliefs. The only custom that they cling tenaciously to is that relating to polygamy.

The Eskimos of the Atlantic coast, under the control of the Moravians, number nearly 1,000 persons. Those at Nachvak and Cape Chidley do not exceed fifty. A few families occupy the coast of Ungava bay from Cape Chidley to the mouth of Koksoak river; these are engaged, during the summer, fishing for salmon in the mouths of George and Whale rivers, there being about a half-dozen families at each place. In 1893 there were fifty-one families scattered along the shores of Ungava bay from Cape Chidley to Cape Hopes Advance. Along the south shore of Hudson strait, from Cape Hopes Advance to Cape Weggs, live some thirty families, while to the westward of these, as far as Cape Wolstenholme there are about seventy-five natives living on the coast, principally in the neighbourhood of Deception and Sugluk bays and near Cape Wolstenholme. About one hundred more, not included in the above, live inland and trade at Fort Chimo.

The western Eskimos, who trade at Great Whale river, number about eighty families, including a dozen families from the Belcher islands, together with a few living about Fort George and on the islands of James bay.

Allowing four or five as the size of the average family, the total Eskimo population in the Labrador peninsula amounts to

Aivillik Women at Fullerton.

about two thousand persons, divided about equally between the Atlantic coast and the remainder of the peninsula.

ANNUAL ROUTINE.

The Eskimo, even to a greater extent than the Indian, depends upon the chase for his existence. The Indian is dependent, in the uncivilized state, on the animals he kills for food and clothing, while the Eskimo must not only get his sustenance and raiment by the chase, but also his fuel, which is either obtained from the blubber of seals and whales, or from the fat of the barren-ground caribou.

The yearly round of life of the Eskimo differs but little anywhere, except on the Atlantic coast of Labrador, where it has been modified by the missionaries. A description of the annual life of an Eskimo of the east coast of Hudson bay is typical of that of the other tribes, and only accidental variations occur, due to the prevalence of particular game, such as the musk-ox, in some regions.

During the winter the Eskimo lives in a snowhouse or *iglo;* in the summer in a tent or *tupik*, made of seal or deer skins. The year begins with the lengthening days of January, and this is usually a period of hard times, lasting for a couple of months. The Eskimo of the southern regions is then on his yearly journey to the trading post, where he will exchange the proceeds of the past year's hunt for ammunition, tobacco, and a few luxuries of clothing and tools. The ice along the coast in January does not extend far from the shore, and the seals keep in the open water, where they can only be killed by being shot from the edge of the ice. This is a very uncertain subsistence for the native, owing to the storms of the season, which either break the ice from the shore, or crowd its edge with small floating cakes, forming an impassable barrier to the open water. If a good supply of deermeat has not been laid by during the fall, periods of starvation are now frequent; these, when severe and

prolonged, result in death or disaster, more natives dying at this time than throughout the rest of the year. The annual journey is made in stages; the native remains in a suitable spot for killing seals until enough of these animals has been secured to meet the requirements of food for the family and dogs, for a few days; then everything is securely lashed on the long, narrow sleds, and the party, usually consisting of two or more families, travels slowly southward along the shore ice, a woman often walking ahead of the dogs to encourage them. The men wander about on the ice in search of seal-holes, and occasionally secure a seal while on the journey. In the evening a halt is made, and the men build a small snowhouse with blocks cut from a convenient bank. These small houses, built only for the night, seldom exceed nine or ten feet in diameter, and it is only when a considerable stay is expected that larger houses are built.

The Labrador Eskimos rarely live more than one family in a house, but on the west shore of Hudson bay and at Cumberland gulf two or more families often live together, either in connected houses or in a single large house. The largest single house, seen by the writer, at Cape Fullerton, was twenty-seven feet in diameter and twelve feet from the floor to the centre of the dome; it was inhabited by four families. This house was too large for the material, and the roof had to be supported by props shortly after being built; but several others, eighteen feet in diameter, showed no signs of such weakness.

The Eskimo first tests the snow of the neighbouring banks by probing with his long snow-knife, often a twelve-inch butcher knife, and when he finds a bank formed by the drift of a single storm, he cuts an oblong hole about five feet long, two or three feet wide, and about twenty inches deep, with a clean face on one of the longer sides. He next cuts blocks from this face; these blocks are about five or six inches thick, from twenty-four to thirty inches long and twenty inches deep. A line the width of the block is first drawn on the surface, then

Snowhouses at Fullerton.

cuts are made at the ends and bottom of the block, after which the knife is thrust down several times along the rear line and the block is wedged off. One man usually cuts blocks, while another builds the house. A circle the size of the intended house is traced on the surface of the snow, and the first circle of blocks arranged around it. When this is completed, the first few blocks are cut down diagonally, so that the next layer of blocks will take a spiral form and continue to wind in a decreasing curve until the dome is closed by an irregular key-block. This manner of building is superior to a succession of lessening circles, as each block is so cut as to be held by the one placed immediately before, and thus one man only is needed at the work, whereas, if the circular method were used, the different blocks of the circle would require to be held in place until the circle was complete. The finished house is a snow-dome of about two-thirds the height of the diameter of the base, with the arch flattened towards the summit. When all the blocks are in place, the cracks between them are chinked with loose snow, generally by the women. A line of blocks is then placed across the centre of the floor-space opposite to where the door will be, with other blocks at right angles to thus reduce the floor-space to a rectangle extending from the door to the centre of the *iglo*. On the far side of these walls, blocks of snow are thrown, and cut to form a smooth platform about eighteen inches higher than the original floor; this forms the bed of the family, while the side platforms hold the camp and cooking utensils. A door is now cut in the wall opposite the bed; it is about thirty inches high and eighteen inches wide, and passes into a tunnel porch several feet long and somewhat larger than the door, built later, and serves as a shelter for the dogs. When the house is permanent, the porch is built with two or more lobes with doors at each contraction.

While the men are finishing the porch and other work outside, the women take the bedding and household goods from

the sled and put the house in order for the night. The bed is formed by laying, upon the snow, mats of closely woven branches of a small willow, which separate the deerskins from the snow. The bedding is composed of several thicknesses of deerskins, dressed with the hair on; these completely prevent any cold from penetrating from below. On the bed thus formed rest the deerskin sleeping bags, which are only closed for about a third of the length at the bottom, or not at all. The lamp is next put in position, on the shelf at one side of the house between the door and bed. It is made of stone, and rests upon three or four short sticks thrust into the snow. When the soapstone, out of which the lamp is usually made, cannot be obtained, any other easily worked rock is used. On top the lamp is roughly triangular in outline, the sides of the triangle being long concave curves. There is one long side and two equal short ones which meet each other in a wide angle; this results in a triangle with a base about twice the length of the vertical. The length varies from ten inches to more than thirty inches, eighteen being an ordinary length. The upper surface of the lamp is slightly hollowed to form a receptacle for the blubber and oil. The lower side is curved so that the lamp has a thickness varying from an inch to two inches. The lamp is fed with seal blubber, or deer fat; the former most commonly. The blubber is cut in thin strips, partly suspended above the lamp on a stick, and a part of it bruised to start the extraction of the oil. A wick of dry, pulverized moss is placed around the edge of the lamp, and squeezed deftly into shape by the finger and thumb, after being moistened in the blubber. When the wick has been properly arranged, it is usually set alight with an ordinary match, or with a flint and steel, iron pyrites often taking the place of flint. The old usage of making fire by friction is seldom employed, and only in the case of the absence of the easier methods. At first the flame from the lamp is small, but the heat soon warms up the stone, and the blubber melts without much attention. As

Interior of Snowhouse at Fullerton.

the flame increases the wick requires considerable manipulation so that the flame may burn evenly around the lamp and not cause smoke.

The more remote Eskimos suspend an oblong kettle of soapstone over the flame to melt ice and cook food, but most of the natives, having access to traders, have largely given up the use of the stone kettle and use tin ones in its place.

Cooked food, with its accompanying broths, is preferred to raw, but the Eskimos are not averse to raw meat, especially liver, the fat portions of the deer and all fish during the winter.

While the women are arranging the interior of the snow-house, the men are busy unharnessing the dogs, feeding them with large lumps of seal or other meat, or with fish, which the dogs devour ravenously after their twenty-four hours' fast. The harness and other things liable to be eaten by the dogs are either hung out of reach or taken into the house. If the night is stormy a couple of blocks of snow are put to windward of the hole from which they are taken, thus making a shelter for each dog. Many of the dogs disdain such shelter, and on the coldest stormy nights lie curled upon the highest place available, evidently preferring the cold to being drifted under by the snow in the holes prepared for them. The Eskimo, as a rule, is very considerate to his dogs, and only treats them violently at rare intervals. Then he uses the long heavy dog-whip to some purpose, and the dogs retain for all time the remembrance of it.

When more than one family live in a house, each has its independent lamp, and the family cooking is kept separate. Seals and other food are, to some extent, common property; that is, if an Eskimo kills an animal when alone, he divides it amongst his neighbours, who return the compliment. When hunting in company the customs vary with the animal killed and with the tribes; there is a great deal of etiquette observed, and as a rule each member of the party is entitled to some portion of the carcass.

The dog-sled on the east coast of Hudson bay, where drift-wood is abundant, varies in length from twelve to twenty feet, sixteen feet being an average length. The runner is usually formed of one piece the length of the sled, but in the north, where wood is very scarce, the sled is shorter, and the runners are frequently formed of two or more pieces spliced and lashed together with seal line. Where wood cannot be obtained, whale-bones form a substitute, and even ice is sometimes used as sled-runners.

The runners vary from two to three inches in thickness, and are four to eight inches deep. They are placed about fifteen inches apart, thus forming a long narrow sled. They are joined by a number of cross-bars, which vary from three to six inches in width and are about an inch thick. They are placed close together when possible, and cover the space between the runners extending from the rear end for two-thirds the length of the sled. These cross-pieces are securely lashed to the runners with seal-line, no nails being used in the construction of the sled. The ends of the bars project a short distance outside the runners, and are there nicked for the lash-line with which the load is secured to the sled. The runners are shod with ivory, bone from the jaw of the whale, or with hoop iron or steel. Shoeing made of pieces of walrus ivory is most prized. The ivory is cut into slabs about a half an inch thick; holes are bored through the slabs at intervals of about an inch, and the slabs are attached to the runner by wooden pegs through these holes. The slabs are rarely more than eight inches long, and a great deal of ingenuity is often displayed in the fitting of them to cover the bottom of the runner. An ivory-shod sled is one of the most valuable possessions of an Eskimo.

When whalebone is used it is attached to the runner in the same manner as ivory; that is, with small wooden pegs, but the slabs of bone are usually several feet in length. Iron or steel

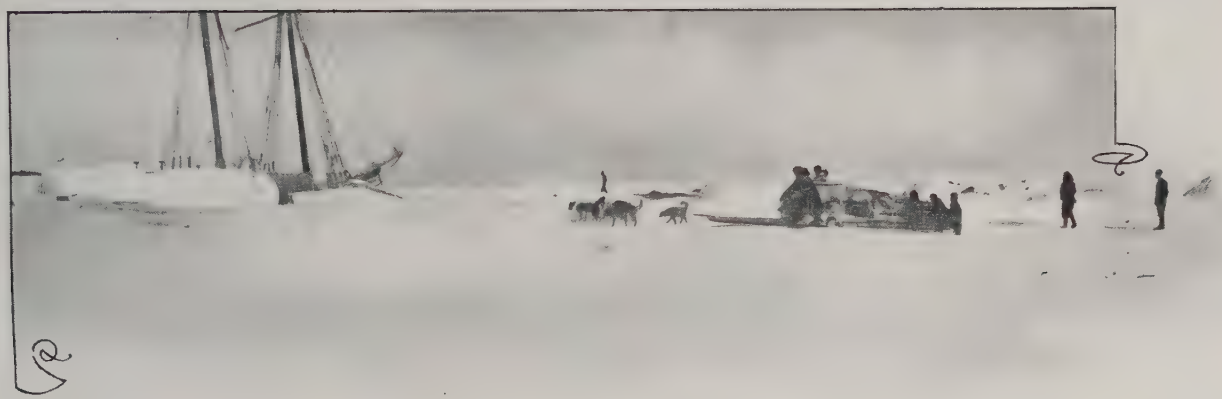
Loaded Sleds from Chesterfield Inlet.

are bad substitutes for bone or ivory, as they offer much more friction in cold weather when the snow is fine and gritty.

During the period of intense cold, lasting from December to April, the shoeing of the sled is of mud or lichens, frozen over the regular shoeing. The best material for this purpose is the dark brown peaty muck formed from the decay of mosses in swamps. Where this cannot be obtained, the white reindeer moss is mixed to a thick paste with water. This shoeing is attached to the runners in the following manner:—when cotton rags are available, these are wetted and frozen to the bottom of the runner, so as to cover the shoeing and extend a couple of inches up both sides of the runner. The muck, which has been boiled to a thick paste, is then applied warm over the cloth, and is roughly shaped by hand, so as to have a thickness of about an inch, with a section resembling the bulb of a heavy steel rail. After being roughly shaped, the muck is allowed to freeze hard, when it is worked over with a wood plane, and the inequalities are reduced to a smooth surface. It is then covered with a thin film of ice, either by lightly running a rag wet with warm fresh water over the surface, or by squirting a small even stream from the mouth. Great care is taken to have the iceing uniform, and every portion of the muck covered. This coating of ice is renewed every morning, and a sled so shod slips over the intensely cold snow with much less friction than when shod in any other known manner. As the weather gets warmer this muck is removed, and the ivory, bone or iron shoeing used.

The number of dogs in the team varies from eight to two or three, an average team being six. Each dog has a separate trace. The harness is formed of two loops of sealskins, which pass under the forelegs, and are sewn together on the breast and joined by a strip about four inches long over the shoulders, thus forming an opening for the head. The loops are brought together in the middle of the back, and the trace is there attached to their united ends. The trace is made of a single length of

line cut from the skin of the Big seal *(Phoca barbata)*, and varies in length from ten to thirty feet. The traces are regulated in length, so that the dogs when pulling straight ahead have the leading dog about two yards in advance, and the others in pairs about a yard behind each other. The traces are made long in order that the dogs may not be massed in passing rough or thin ice, and for the same reason the traces are not fastened to the front of the sled, but to a loop of walrus line which is attached at the first bar, or nearly a third of the length back. By this means the sled is easily turned, and allowed to run at a considerable angle to the direction in which the dogs are travelling; advantage is thus taken of the smoothest places when journeying along the broken ice piled upon the shores. The use of individual traces is not without its drawbacks. While travelling the dogs constantly cross from side to side among themselves, and weave their traces into a single rope. Stops must be made every few hours to untangle the traces. The long trace is also constantly fouling hummocks while passing over rough ice; when this occurs the dog is pulled back to the sled by the fouled trace, and if he does not get hurt physically, at least his pride is offended, so that, when freed, he usually has a little unpleasantness with every dog he passes to regain his place in the team. The leading dog answers more or less satisfactorily to the word of command, and is followed by the other dogs. The usual commands are to swing right or left, to start and to stop. The dogs are very acute of hearing, and the words are usually given in a low tone. When a dog is to receive punishment he is pulled back in the team and his shortened trace made fast to the sled; the driver can then give his undivided attention to the whip. A great deal of dexterity is shown in using the whip, and a lot of time is spent practising with it. A good whip handler knows at least four or five different cuts, and can hit within an inch or so anywhere inside the length of the long lash. The blow is terrific.



A Small Team and a Heavy Load.

BOSTON
LIBRARY

When an Eskimo leaves a snow-house, his household goods are removed by breaking a hole in the side of the wall. They are then loaded on the sled, and retained by cross-lashings of sealskin passed from side to side, where they are secured in the niches of the cross-bars.

When the ice has frozen several miles out from the shore many of the seals remain in the shallow waters of the bays and sounds. In order to do this they are compelled to keep holes open so that they may breathe from time to time. They form these holes either by enlarging natural cracks or, when such do not occur, by scraping with their front flippers a conical hole big enough to admit their body and with a few inches to spare at the surface. As the time approaches to bring forth her young, the female enlarges a hole, usually in rough ice where the snow is deeply drifted, and there clears away the snow about the hole, forming a flat-domed house sufficiently large to accommodate herself and her young. The pups are born in March and April. A seal does not necessarily confine itself to one or more breathing holes of its own, but uses those of other seals, so that the chances of killing a seal at any particular hole varies. The Eskimo now forsakes the edge of the floe and hunts his seals at these holes. In order to find the holes he employs his keenest scented dog, harnessed, who soon smells a hole and rushes to it dragging his master with him. If the hole appears well frequented, and the Eskimo is anxious to obtain a seal, he takes the dog some distance away and ties him securely by his trace to the ice. He then returns to the hole, and clears the snow from about its opening, replacing it with a fresh thin slab, on which the centre of the hole is plainly marked. If he intends to remain until a seal comes, he often erects a low wall of snow to windward, and sometimes places a block close to the hole as a seat. A piece of deer or bear skin is put down to stand on; he then ties a thong around his legs at the knees so that they may make no noise by striking together when shivering with the

cold. All preparations being complete, he stands or sits absolutely motionless for hours until a seal comes to the hole to breathe. The slightest movement or noise made as the seal approaches raises suspicion and the animal goes elsewhere. The near approach is heralded by strings of bubbles formed by the animal emptying its lungs as it rises to the hole. When its nostrils are above the water and it begins a series of long inspirations, the Eskimo noiselessly brings his spear directly over the centre of the hole, and strikes down with his full strength, hoping to drive the barb into the brain and immediately kill the seal. This often happens with small ones, but with the large ground-seal a single blow rarely kills it, and a struggle between man and victim then takes place. The winter seal spear is from five to six feet long. It consists of four parts, the barb, the iron rod on which the head fits, the wooden shaft and the iron ice-chisel at the end opposite to the spear. The head or barb is now almost always made of iron, the ancient ones being of stone, or iron and ivory. It is about three inches long, and quite narrow in proportion to the length; the point is formed into a slender barbed spear, with a small hole at its base which fits the iron rod of the handle. Near the centre is another hole, at right angles to the length, to which is attached several fathoms of seal line. The rod of the shaft is from fifteen to thirty inches long, and is usually made from three-eighths or half-inch iron or steel. At the upper end it is pointed to fit the hole in the base of the spearhead; at the lower end it is securely fastened to the wooden handle by being driven into it to the depth of three or four inches, and the end of the wood is strongly bound with sinew. The wooden handle forms the middle portion of the spear; it is usually about two feet long, and of sufficient circumference to afford a strong and convenient grasp. A small peg of ivory projects about half an inch from the side of the wooden handle, and over this peg a small loop attached to the spear line is passed. This keeps the line taut,

BOSTON PUBLIC LIBRARY

Interior of Snowhouse at Fullerton.

and holds the head securely in place on the end of the rod. When a seal is struck the loop slips from the peg and the spear-head is detached from the handle. In striking a seal, the handle is held in the right hand and the line in a coil in the left. Immediately the animal is struck the hunter lays down the handle and devotes himself to the line. If the seal is a large one and struggles much, a turn of the line is taken around the waist, and the hunter braces himself for an encounter, in which the seal is sometimes the victor. Great care is necessary in paying out the line, for many a finger has been lost by becoming entangled in a loop. The violently struggling seal must soon breathe, and to do so is compelled to rise in the hole; then the hunter endeavours to drive the pointed rod into its brain, and usually does so very quickly. The hole is then enlarged with the ice-chisel on the end of the spear handle. The chisel is commonly made of half-inch square iron or steel firmly sunk into the wooden shaft and fined down to a long chisel-edge. When the seal has been hauled on the ice a number of ceremonies are gone through in order to propitiate its spirit and to please the goddess of the marine animals. One of the customs consists in bursting the eyes so that the seal's spirit may not see that it is being taken to the snow-house. Of course these customs are falling into disuse among the Christianized Eskimos of Labrador and Cumberland gulf, but there remains, even among the most enlightened, a strong leaven of their ancient superstitions and customs.

At every stopping place traps are set for foxes. The trap is usually a single-spring steel one, of which each native usually has two or three. The traps are set on the snow and covered with a thin sheet of hard snow, the bait being hidden alongside. Where steel traps are not available, long narrow boxes of stone or ice are constructed, with the bait in the back part, and attached to a dead fall, so that when it is disturbed, the door falls upon the fox. The Arctic fox is generally plentiful in the

early winter months, when many of them travel southward along the coast.

The months of January and February are passed by the Eskimos on the journey to the trading post, where a short stay of a few days is made to dry the fox-skins caught during the winter, and to trade these along with deer and other skins in the shop. There is no cash used in these transactions; the skins are handed over to the trader, who values them from a standard of a white fox skin. When the amount has been made up, he hands to the native a number of tokens representing the value of his hunt in fox-skins. The usual tariff is about as follows:—

White fox = 1 skin.	Mink = 1 skin.
Blue fox = 2 skins.	Marten = 2 skins.
Cross fox = 5 to 15 skins.	White bear = 4 to 10 skins.
Silver fox = 15 to 40 skins.	Deerskin = ½ Skin.
Otter = 4 to 8 skins.	

The Eskimo trades back, over the counter, the tokens received for his hunt. The first purchase is a supply of tobacco; next comes ammunition, and then follow tools, cheap clothing, needles, tin kettles, knives, files, &c., until his stock of tokens is used up. The immediate profit on the goods supplied is very great, but when the cost of transport and the maintenance of the post are taken into account the profit, which appears enormous at first, is found to be not excessive, considering the precarious nature of the fur trade, with its fluctuating market and the chances against good hunts.

The trading completed, the natives collect in large bands on the ice, usually in the vicinity of some long crack or other place where seals are abundant, and spend the next month going from encampment to encampment visiting friends and exchanging the news. With the first signs of mild weather a start is made northward. Life now is very pleasant; the days are long and becoming mild; seals are killed in large numbers on the ice, as they lie basking and sleeping in the warm sun. A good deal

of patience and some excellent mimicry is displayed in killing seals at this time. When one is seen lying near its hole, the native approaches as near as possible, say within 500 yards, when he lies down and crawls and wriggles the remainder of the distance. During this operation great care is taken not to excite the animal's suspicion, and an advance is only made when the seal's head is down. A seal appears to sleep in short naps, and raises his head every few minutes; when he does so the hunter immediately hides his face, and with his arms and legs imitates the motions of a seal scratching or lazily rolling, at the same time mimicking the blowing and other noises made by the seals; by so doing he soon lulls suspicion, and is enabled to crawl a little closer. By advancing in this manner he can get within fifty yards of his prey, when he shoots it. When the native has no gun, he continues to close in until sufficiently near to kill with his lance; this must, however, be done quickly, for the seal displays wonderful agility in falling into the water when disturbed.

Early in May the few families who intend to pass the summer inland leave the coast and hurry to their destination before the sun melts the snow. The greater number pass the early summer on the coast.

With the advent of June the snow begins to melt, and soon after the land becomes bare. This is a period of trial for the house-wife; the warmth causes the roofs of the snow-houses to leak, and they can only be kept up by a daily patching with loose snow, while the ground is not sufficiently bare for the erection of the summer tent; it becomes a constant fight with the heat and water, terminated only by the roof falling in. The smell and general filthiness of one of these deserted spring houses is better left to the imagination; it is indeed beyond description. During this time, while the ice on the coast still holds, the men are busily employed killing seals, whose skins are needed to repair the summer tent and to cover the Eskimo's

boat or kyak. The men bring in the animals and skin them, after which the skins are handed to the women to dress. If they are to be used to repair the tent, or for bags, they are simply dried by stretching them on wooden pegs about six inches above the ground. If they are required to cover the kyak, or for boots, the hair is scraped off with an ordinary chopping knife, against the grain, and the film is removed from the inner skin. For winter boots, the hair is rotted off and the skin has a white colour, but it is not water-proof.

As soon as a convenient level spot of ground is bare of snow the snow-house is abandoned and the summer tent erected. The tent is of a ridge-pole pattern, with the ridge from six to ten feet long, resting in the front in the socket between two crossed poles and at the rear terminating at the apex of a number of poles which form a half cone to the back of the tent. The ridge is about six or seven feet high, and the frame over all about twelve feet long and about nine feet wide on the ground. The covering is made either of seal or deer skins, except in the case of a man of wealth, who has a cover of cotton. Both the seal and deer skins used for this purpose are dressed with the hair on, and are used with the hairy side exposed.

This is the time to repair, and if necessary make new, wooden frames for the kyak. The kyak is a long narrow boat sharply pointed at both ends, and entirely decked over except a small well sufficiently large for the entrance of a man's body. The frame is of wood, and is covered with sealskins sewn together to make a water-tight cover. Each tribe has a slightly different model, the difference being in the shape of the bow or stern or in the relative width. The Labrador kyak, common to the Atlantic coast and Hudson bay and strait, is nearly twenty feet long, and over two feet wide in the middle, or well section. It has a long sharp bow, which leaves the water about six feet from the forward end, where it stands about fifteen inches above the water. The stern is lower and less sharp,

BOSTON PUBLIC LIBRARY

Eskimo Kyak off Cape Haven.

terminating in a knob about a foot long, which projects slightly above the water. The front of the well is situated about the middle of the length, so that the opening is in the fore part of the after-half of the deck. It is roughly oval in shape, and is surrounded by a wooden combing about six inches deep, so placed as to slope upwards towards the bow. The boat is propelled by a narrow double paddle. The frame is made of thin strips of wood forming the gunwales, and of five or seven additional strips, one of which is the keelson. These are kept in place by light ribs placed about a foot apart, with corresponding deck beams. Considerable mechanical skill is displayed in the making of this frame, which is all fitted together without the use of a single nail, wooden pegs and sinew lashings being alone used.

The natives about Cumberland gulf and along the west side of Hudson bay, who are employed by the whalers, are gradually giving up the use of the kyak, and now do their hunting and travelling with whaleboats, which are supplied to them by the whaling vessels. Each vessel at the end of her voyage generally leaves all spare boats behind. These are distributed among the natives, and the result is that nearly every family possesses a boat. The Aivilliks and Kenipitus, of the west coast of Hudson bay, still make use of the kyak for inland hunting, but the Cumberland people take their whaleboats into the interior.

The Kenipitu kyak is extraordinary in shape. It is long and narrow and quite deep, so that the midship section is almost semicircular. The ends terminate in long narrow points, of which the bow end slopes downward towards the water and the stern end is inclined upwards. This kyak is so narrow that the combing of the well sometimes projects beyond the sides. Being narrow and cranky, a good deal of skill is required to handle these craft with safety, and accidents caused by upsetting are not uncommon. These kyaks are covered with parchment deerskin, and are the only ones painted, various colours being

obtained for the purpose from oxide of iron found in the interior.

As soon as the frame is complete, all the women of the encampment join in sewing on the sealskin cover, as the operation when started must be completed at one sitting, before the skins dry. The seams are made with a double lap, and are quite water-tight. The skin shrinks on drying, and becomes stretched like a drum over the frame.

The natives have another boat called the umiak or woman's boat. This is also made with a wooden frame covered with skins, but it is much larger than the hunting kyak of the men. In shape it roughly resembles a large square-ended punt, being often twenty feet and over in length, by six feet or more across the middle section, and tapering towards the ends to about half that width. It is made quite deep, and is capable of carrying a very heavy load. Usually two or more families use a single umiak to transport their goods from place to place, and as the poles and Big sealskin covering of each tent weigh upwards of half a ton, the capacity of these boats can be realized.

The framework is heavy, and the sides are kept in place by a number of cross thwarts, which also serve as seats for the rowers. The covering is made from the large skins of the Big seal *(Phoca barbata)*, sewn together in a manner similar to the covering of the kyak. This craft is rowed by the women, usually with an old man as steersman. It is propelled by rude oars made from small trees, the handle being formed from the thick part, while the blades are made by attaching strips on two sides of the smaller end. Two or more women pull each oar, which vary in number from two to four.

The only place where such boats are known by the writer to be used is along the south side of Hudson strait and about Ungava bay. Elsewhere the whaleboat has been found more convenient, and when the planking is worn out they are covered with sealskin.

During the month of June the weather is generally fine, and ducks and geese are plentiful in the open water of the ponds and sea. The ice becomes very rotten towards the end of the month, and soon after breaks away from the shores, when the kyaks come into use. This is the most pleasant season of the year for the Eskimos, and they always sing about its pleasures in their sing-songs to be described later. Game of all kinds is abundant; the deer come to the coast at this season; seals are plentiful in the open water, and walruses are floating about on the loose ice; the Arctic salmon swarm in the shallow water along the coast, and thousands of eggs of the sea fowl may be collected from any of the smaller outer islands. A little later the white porpoise enters the mouths of the larger rivers in schools, and is killed with the harpoon and gun from the kyaks. The summer harpoon differs from the winter one, in that the iron work of the latter is replaced by ivory obtained from walrus tusks. The handle is stout, and made of wood from four to six feet long; at one end it is tipped with ivory, with a cone-like socket in its upper side, into which a similar cone on the lower end of the ivory shaft fits. The two are joined together by a thong of seal-line passing through holes in the ivory of each piece about two inches from their ends. This thong is made tight, and holds the cones in place while the harpoon is in use and until the head enters some animal, when the weight of the shaft causes the cones to slip and the shaft hangs loose from the wooden handle. The shaft is usually made from a single tusk, and is from twelve to eighteen inches long, but sometimes it is made by splicing two pieces, and they are joined by bands of lead run through mortised holes in the two pieces. The shaft in its lower end at the cone is usually over an inch in diameter, and tapers slowly to the upper end, where it is about a quarter of an inch thick. There is generally the natural curve of the tusk in the shaft, so that it is not quite straight. An ivory head fits the upper end of the shaft, and it is tipped by an arrow-

pointed piece of iron, usually an old knife blade, let into a slit in the ivory and secured by rivets. The head is about four inches long, and is pierced near the middle for a seal-line attached to it. This line is several yards long, and is fastened at its outer end to a whole sealskin blown up to act as a float and drag to the animal harpooned. The head of the harpoon is kept in place by a loop on the line, which fits tightly over a peg on the side of the wooden handle when the head shaft and handle are adjusted in line. The harpoon is thrown at the seal, walrus or whale, and its weight is sufficient to drive the head completely through the skin; the cones between handle and shaft then turn and disjoint allowing the line to slip off the peg on the handle, so that the head separates from the remainder, which floats away. The sealskin bladder is thrown overboard, and after a few wild rushes the animal comes to the surface, dragging it along. The native then either shoots, or kills with the lance. The lance is somewhat similar in construction to the harpoon, but is without the head, the ivory shaft terminating in a wide steel blade usually cut out of a saw or large knife, and is without barbs.

The other weapon of the kyak is the duck dart used to entangle the eider ducks when they become fat and lazy in the late summer. This instrument consists of a light wooden shaft five or six feet long, with a trident of deer horn at its upper end. The pieces of horn are from six to eight inches long, and about half an inch in diameter; their sides are notched by a number of barbs pointing downwards, and they are so set at the head of the shaft as to project outwards at an angle of 45°, while each piece of horn makes an angle of 120° with its neighbours. Similar barbed prongs are attached to the shaft about a foot from the upper end. The lower end of the shaft is flattened, and made tapering to fit a groove in a throwing board held in the hand of the hunter. This dart is very skilfully

Summer Tents at Wakeham Bay.

thrown many yards, and entangles itself about the necks or in the wings of the ducks.

As the middle of August approaches, the natives who have been living on the coast, and who have generally secured several sealskins full of porpoise or seal oil for the next winter's use, start inland for the annual deer hunt, only leaving behind the old people who cannot tramp long distances. These pick up a living during the absence of the younger people by fishing and hunting birds. The barren-ground caribou collect in great bands in September for the mating season and for their annual migration southward. At this time their skins are in the best condition for clothing, and the Eskimos kill them at certain localities where they are known to pass on their way south. These places are often far away from the summer hunting grounds on the coast. Going to the hunting grounds the course of some river is generally followed, the men travelling in their kyaks, while the women, children and dogs all carry heavy loads overland. The early autumn is spent on the deer grounds, and a return to the coast is not made until sufficient snow has fallen to allow of the use of the dog sleds. The men first travel light to the coast to fetch the sled left there the previous spring. On their return the heavy, slow work of hauling out the meat and skins commences, and as several loads are often necessary, with the days very short and the snow soft, it often happens that Christmas arrives before the coast is again reached, and the trip for the trading post again undertaken.

This is a short description of the life of an Eskimo living in the northwestern part of the Labrador peninsula, and is typical of the life of the free native in the north. Of course, the routine varies in different localities. On the west side of Hudson bay the Kenipitus live inland, and depend entirely upon the caribou for food, clothing and fuel. A large number of these natives only leave their hunting grounds for short visits to the

whalers, to renew their supplies of ammunition and tobacco, or go to the northward to hunt the musk-ox in the spring.

The Aivilliks of that coast confine themselves chiefly to the seaboard. Their name signifies walrus hunters, and they go inland in the autumn only to procure sufficient deerskins for their winter clothing.

The Nechilliks and Igluliks, living farther north, do not often come in contact with the whalers, and depend largely on their southern neighbours for ammunition and other articles of civilization. They are in a much more primitive state, without any modifications in their ancient customs and beliefs. The greater number are without guns, and kill their game with the bow and arrow or with the spear.

The other natives on the shores of Fox channel rarely come in contact with the whites, and are in a similar primitive state. These include the Padliks and Sikosiliks, and in the same category were the natives of Southampton island, now all dead.

The Eskimos living about Frobisher bay and Cumberland gulf congregate about the whaling stations, and remain there for the greater part of the year. The whaling season in these places is in the fall, spring and early summer, so the natives have only the latter part of the summer in which to hunt deer for their winter clothing. The animals are found abundantly about the great lakes Nettilling and Amadjuak, which are located far inland to the westward.

The natives of Big island and the north shore of Hudson strait are, as before mentioned, employed on the Scotch whaling steamer, or at the stations at Repulse bay and at Lake Harbour, where a mica mine is worked; consequently they do not follow their old customs.

A whaling station was established in 1903, at Ponds inlet, and the Eskimos of the northeastern part of Baffin island will

soon have their habits modified by contact with the white men; of all these northern people only those of eastern Baffin island, together with those of the Arctic coast to the northwest of Hudson bay, will remain practically uninfluenced by civilization or Christianity.

At Ponds Inlet.

CHAPTER VII.

ESKIMOS (CONTINUED).

The natives of the Labrador peninsula and those of Cumberland gulf, under the influence of the missionaries, are gradually giving up many of their ancient beliefs and customs. At present these can only be studied among the tribes as yet unvisited by the missionaries, such as those of the northwest coast of Hudson bay, who, although long acquainted with the whalers, have not been so influenced by them as to change their superstitions and beliefs.

The writer spent the winter of 1903-04 among the Aivilliks and Kenipitus on that coast, and paid some attention to these

matters, deriving at the same time a large amount of information from Captain George Comer, of the whaling schooner *Era,* wintering alongside the *Neptune.* Captain Comer had already made several voyages to Hudson bay and Cumberland gulf, on all of which he had made ethnological collections and notes for the American Museum of Natural History, New York. A considerable amount of his information has been published by Dr. Franz Boas. With the exception of the Rev. Mr. Peck, at Cumberland, Captain Comer is probably the greatest authority upon the manners and customs of the Eskimos.

The different tribes of Eskimos have no hereditary or elected chiefs. Each tribe is divided into a number of small bands, usually close blood relations. The head man of each band is nearly always advanced in years, and holds a sort of patriarchal sway over his sons and younger relations, altogether due to their willingness to be guided by his advice and experience and not to any sense of duty. At other times, when the older men are not forceful in character, a successful younger hunter largely influences the actions of the band. The authority of the leader is not great, and he never asserts it by direct orders issued to the other men; if he wants anything done he asks them if they are willing to do it; any member is quite at liberty to refuse, and to follow his own judgment or inclinations.

The head man is usually an *Angekok,* conjuror or medicine man, and in consequence derives some power over the band through their superstitions. It is not quite clear if more than one angekok belongs to each band, but they are quite numerous, and it seems likely, therefore, that the number is not limited to one.

As regards the family relations among the uncivilized Eskimos, the marriage tie is very loose, and can easily be broken by either party. This is often done for the most trivial cause. The Eskimos practise polygamy, and in some tribes, polyandry, where there are fewer women than men. Many of the men

have but one wife, owing to their inability to support more, the successful hunter being known by the number of his wives, although two is the usual limit. There does not appear to be any ceremony in connection with marriage, beyond a present to the nearest male relative, who gives his consent to the union.

Divorce is common, the chief causes being failure to produce male children and incompatibility of temper. When a woman is divorced she returns to her family, taking her children with her, and both parties are free to form a new alliance.

Jealousy caused by infidelity on the part of the wife is exceedingly rare, the man taking rather a pride in the appreciation of his wife's charms by others. The women are jealous of one another, and I have seen a wife take away her husband whom she found dancing on board the ship with another woman.

An exchange of wives is customary, after certain feasts, or after the angekok has performed his conjuring tricks, either to cure sickness or to take away the effects of the breaking of some of the many taboos. These customs make polyandry easy where it is found necessary, as in the case of the Nechilliks, or where only one woman accompanies a hunting party.

As a rule the women are treated fairly by their husbands, and it is only in the case of a shrew, or of constant neglect of attention to the cooking and other household duties, that corporal punishment is resorted to; but when administered, it is severe.

The missionaries are exerting their influence to make the Eskimos monogamous; this is probably a mistake. In a greater number of the bands there are more women than men. Under their old customs, a man had as many wives as he could support, and all of them were nearly on an equality. Under the new practice he has but one wife, and the other women whom he supports have no standing in the household, being domestic drudges and concubines.

The Eskimos display a great deal of affection for their children, especially if they are boys. Corporal punishment is

rarely, or never, inflicted, and does not appear to be required. In the case of orphans, or where a man is childless, adoption often takes place, a child sometimes being bought from its parents. Adopted children are rarely treated harshly. Instances of the destruction of female children are known, but they are rare.

The aged are respected, and as a rule well looked after. In cases of starvation, the aged sometimes voluntary elect to be left to starve, or die of cold; in rare cases of this kind, old people, or cripples, have been known to be abandoned, but it has generally been a choice between being embarrassed by these weaklings and all perishing, or of leaving them on the chance of the remainder of the party surviving.

Cases of murder and cannibalism during periods of starvation have been authenticated among the natives of the west shore of Hudson bay, and have been reported among other tribes, but are resorted to only in extreme cases.

Murder from private reasons is very rare, and entails a blood feud unless a settlement can be made by presents to the nearest relatives of the murdered man.

If an individual becomes dangerously obnoxious, or insane, a consultation of the men of the band is held, and one or more of them are deputed to remove the criminal or lunatic; in such a case the individuals acting are held blameless in the matter.

Supposed incurables commit suicide, which is not looked upon as a crime, as suicides are supposed to go, after death, to an upper heaven along with other good people.

When a death occurs, the body is sewn up and kept for some time in the iglo, after which it is drawn to a convenient spot on the land, and there covered with boulders as a protection against dogs, wolves and foxes. The body is removed from the snow-house through a hole cut in the side, and not through the door. The reason for keeping the body a few days is due to the belief

that the spirit hovers about it during that time before departing, and might be displeased if it were buried immediately.

There appears to be a great deal of doubt in regard to the action of the soul after death, and at times one is led to think that the Eskimos believe in a dual soul, one of which leaves the body and its surroundings shortly after death, the other remaining in its environment and gradually departing for longer and longer periods as the body decays.

A number of customs are observed after death among the Aivilliks and Kenipitus. No work or hunting is permitted for five days, and the women confine themselves closely to the house. During this period the snow must not be scraped from the ice window, the bed must not be shaken, nor the willow mats disturbed; the drippings from the lamp must remain, and snow for melting must not be cut. The women are forbidden to wash faces, comb hair or dry boots. The men must not work on iron, wood, stone or ivory. Some of these regulations extend beyond the period of five days. The belongings of the dead are not used by the others, and, if they cannot be traded to the whites, are abandoned. When a man dies, his gun and hunting implements are laid beside his grave, and allowed to remain there for a certain time, until his spirit is supposed to have no further use for them, having ceased to remain with the body, or until the spirit is supposed to have forgotten about them. In the case of a woman, articles of a personal nature of use to the spirit are put alongside her grave. For some time after death visits are made to the grave, and one-sided 'conversations' are held with the spirit there to show respect and to keep it from becoming lonely; at the same time small presents of tobacco or other articles are left at the grave.

SUPERSTITIONS AND BELIEFS.

It is an exceedingly difficult task to arrive at any sure idea of the beliefs of the Eskimo. In the first place, they are them-

selves somewhat hazy as to what they do believe concerning the soul and a future state; secondly, an intimate knowledge of the language is needed to catch their ideas on these subjects, and thirdly, one must be very intimate with them and have acquired their respect before they will, from fear of ridicule, discuss such subjects.

They all appear to have a belief in a supreme goddess, called Nuliayok on the western side of Hudson bay, and Sedna by the eastern Eskimos. The folk-lore in connection with these two goddesses points to the same origin for both, and is almost identical. The tradition is that Nuliayok was a coy Eskimo maiden who would not marry any of the young men. She was wooed by the fulmar, a gull, who spoke in a pleasing manner of the life she would lead with him. He so worked upon the senses and feelings of the maiden that she consented to accompany him to his island home as his wife. On arriving there she found that she had been cruelly deceived, and that the splendid house was nothing but a nest of sticks perched upon the high bare rocks, without any shelter from the snows or winds. The abundant food promised turned out to be nothing but rotten fish, and to add to her other discomforts she was jostled by the other fulmars, so that she often had difficulty in preserving her place on the rock. There was plenty of time for regret before she managed to send word to her father, requesting him to come to her rescue, which he did. Her father's name was Anautelik, and he took her away in his boat during the absence of the fulmar. When the latter discovered his loss, he caused a great storm, and Anautelik, to preserve his own life, threw his daughter overboard, but she clung to the side of the boat, and he cut off her fingers, one by one, to make her release her hold. As her fingers dropped into the sea they changed into the whale, walrus, big seal and the small seal, so originating the sea animals. Her father next knocked one of her eyes out, after which she let go of the side of the boat and went to the world

beneath the sea, where she became queen, living in a house built of stone and whalebone, and guarded by her husband, the dog. She cannot walk, but 'hunches' over the ground with one foot beneath her body. Her father was also drowned later, and now lives with her, wrapped up in his tent cover, and is employed torturing the souls of the wicked. The souls of sea animals go to her after remaining three days by the body after death. This is the reason a great deal of respect is shown to the bodies of these animals, and is the origin of a number of taboos in connection with them. If the soul is displeased on its departure for the abode of Nuliayok it informs her, and causes her hands to swell; then she revenges herself by bringing ill-luck or sickness upon the Eskimos. If all the ceremonies are properly observed they please the soul of the animal, and other animals will allow themselves to be killed by such considerate people.

It thus appears that the Eskimos existed before their goddess, there being no legend regarding the first Eskimo. The Eskimo story differs in regard to the origin of the white race and the Indians, who are the offspring of Nuliayok and her dog. One story runs that Nuliayok was deceived by the dog, who took the form of a young man. When her father found her with a litter of white and red pups he was very angry, and placed her with her strange progeny upon an island, sending food to her by the dog. Later he drowned the dog, and brought her food in his kyak. Nuliayok, to revenge the death of the dog, set the pups on her father, and so killed him. Being now without any source of food for herself or the pups, she made two large slippers; into one she put the white pups and into the other the red, and set them afloat before a north wind, so that they landed on southern lands and became the ancestors of the whites and the Indians.

There is a goddess of the land-animals called Pukimma, who appears to be closely identified with Nuliayok, and may be the same personage under a different name.

Aivillik Woman in Gala Dress.

The Eskimos have in addition to a number of legends concerning the creation of the animals many other folk-lore tales, all of a lewd character, and often without point.

The ideas concerning the future state of the soul are confused and often contradictory. There appear to be three degrees of heaven, all situated above the earth. The conditions are heavenly according to the Eskimo view, which pictures such places as being bright and warm, with plenty to eat and wear, and little to do. It is probable that the idea of eternity is beyond the comprehension of the Eskimos. They believe that the soul of the departed will enter the body of a child named after it, and remain for a year, with later continued influence upon the child's character.

As before mentioned, the souls of suicides go to the upper spirit world along with those who have observed all the taboos. The transgressor of the taboos, and men lost by being carried away on the ice, go to the nether world, where they are tormented for a time by the father of Nuliayok.

TABOOS.

The uncivilized native has a great many strict rules to observe in regard to the modes employed in killing animals, and the manner and time of eating certain flesh. There are also rules regarding work on different materials. If these rules are not closely observed the souls of the animals become displeased, and report the transgression to Nuliayok, who shows her displeasure by bringing sickness, ill-luck in hunting, or some other calamity upon the band in this life, and punishes the individual in the next. When the taboos have been broken they can only be condoned by open confession, in the presence of an angekok, who, through his familiar spirit, reports the confession to Nuliayok, and the sin is forgiven.

The following are a few of the many rules which must be observed: The most heinous crime is the concealment by a

woman of a miscarriage, and is the source of the greatest calamities. A woman so unfortunate must confess immediately to the angekok, but as the confession practically ostracizes her for several months, the temptation to conceal her mishap is great. A pregnant woman is debarred from eating several kinds of meat. After childbirth she is unclean for two or three months, and for the first month cannot visit any house in the community. A similar rule applies to women during their menses. A woman who has recently lost a relative must not work on deerskins, pluck ducks, take the hair off sealskins nor mention the names of the animals. When the men are away hunting on the ice the women must not disturb the bedding, as it will make cracks in the ice, and seal-line used in hunting must be cut diagonally for the same reason. When the sun first returns in the spring the children blow out the lamp in the snow-house. During the time that the sun is travelling south cat's-cradle is played by the women and children to entangle the sun in the meshes and prevent it being lost by continuing south; the cup-and-ball game is played to hasten its return.

Among the many taboos relating to the killing of animals the following may be mentioned: The bear is under the protection of two goddesses, Angeakatille and Ouhowjawtil, who live in an iceberg. No work must be done for three days after a bear is killed, and the women must not comb their hair, nor disturb the bedding. No cannibal may eat bear flesh, lest it should create a taste for human flesh. The newly-killed seal has its eyes punctured, so that its spirit may not see that it is being taken to the snow-house. When the carcass is brought into the house fresh snow is dipped into the kettle and the water from it is dripped over the seal's mouth. Before going sealing, for the first time on the ice, a fire of shrubs is made, and the clothing and implements of the hunter are thoroughly smoked in it. The key block of the snow-house is at the same time scored in all directions with the knife, to ensure good luck in hunting and to

Nechillik Woman.

keep away disease; a white piece of deerskin and thread are put on the ice for the same purposes. Seal bones must not be given to the dogs. The souls of the sea animals abhor dead bodies and blood, which must therefore be avoided by hunters. This rule applies especially to women during their periods. Everybody in the encampment may eat freely of the seals killed by the successful hunter, but none of the meat must be removed from his house.

During the deer hunt no work must be done with sealskin. The winter clothes and tents must be buried, while no seal or walrus line may be taken inland. When hunting deer from the kyak on the inland lakes a small piece of sealskin is deposited under a stone on the margin of the lake.

When the musk-ox hunt is in progress, the hair must not be removed from deerskins, and no work with iron may be undertaken.

All deerskin garments must be made on the land, and not after the family has moved upon the ice, until the March moon, when the women are allowed to work at deerskins in an iglo on the land, but not on a day when a walrus has been killed. Soapstone is another material which must not be worked on the ice. No work may be undertaken on sealskins killed during the winter, until the seals have pupped. The tusks of freshly killed walrus must not be removed from the skull until the winter, but work may be done during the season on tusks taken before the new ice forms.

When on the ice, deer meat must be taken into the house through a hole in the side and not by the door, until after the March moon, when both deerskins and meat may be taken through the door. Deer must not be eaten on the same day with seal or walrus, except in the walrus season, when it may be eaten with the latter. Clothing must be changed before eating seal in the walrus season.

The first salmon must be caught before work on bootlegs begins, and boots worn while hunting walrus must not be used when salmon fishing. Salmon is always cooked over shrub fires outside the tent, and in vessels used only for that purpose; consequently fish taken in the winter are eaten raw.

Amulets in the shape of small pieces of skin or cloth are sewn to the under coat by the wife of an angekok to ward off sickness and to bring good luck. Many of these are decorated with beads. The tip of the deer's tail is sewn to the tail of the coat for success in hunting, and when sewn to the coat of a boy ensures his becoming a successful hunter. A gull's feather dipped in the drippings of the lamp is placed between the harpoon and spear line, and so carried to the ice, where the hunter sucks the feather and spits in the water in order that the walrus may not know that it is being hunted. The dried skin of a newly-born lemming, when attached to the float of a walrus harpoon, prevents the animal from attacking the boat when wounded, and the skin of a lemming carried in the boat ensures safety.

There are numerous other charms used, together with invocations and songs for success in hunting.

ANGEKOK.

The angekok, or medicine man, is believed by the other Eskimos to possess supernatural powers, whereby he can charm away sickness, lighten the displeasure of Nuliayok when she sends famine and misfortune to the band, put the evil-eye or something similar on those who displease him, and see into the future. He is supposed to do this by the aid of a familiar spirit called his tonwak, which usually assumes the form of some animal—often that of a walrus.

To become an angekok it is necessary to receive instructions in the mysteries from some other angekok, and usually more than one take part in the instruction and initiation of the candi-

date. After being instructed, the novice has a series of incantations performed over him by the assembled angekoks, who dance round him, uttering charms. He is then taken to his home and left for several days in solitude, during which time he meditates and prays for his tonwak to appear; this usually happens after several days, when all that remains to make him a full-fledged angekok is to learn words used by them and unknown to the uninitiated.

The angekok prepares for a séance, either behind a blanket in the tent or in the porch of the snow-house. Some of them appear to be able to work themselves into a sort of mesmeric trance, when they pretend to be able to transport their spirits to distant scenes and tell what is happening there. They also undertake to foretell the results of future hunts, and whether success or failure will follow certain undertakings. In sickness the angekok works all his cures by charms, the Eskimos being entirely without medicines. He ascribes all sickness to the breaking of certain taboos, either by the sick person or by some close relative.

They perform a number of simple conjuring tricks for the benefit of their audience. I was present at a séance at Cape Fullerton, where two angekoks officiated. They made their preparations in the porch out of sight of the audience, who were arranged in rows on the bed, and who all kept crying ' atte atte,' inviting the angekok to enter. Each woman wore a small piece of deerskin on the top of her head. A long conversation was held with the angekok outside, before he finally entered. He first essayed to describe the place whence I came, and in this he was not very successful. He then told us the locality of the Eskimos who had taken our mail south some weeks before; this ended the first part of the performance. The next time, he entered in the form of his familiar spirit, the walrus, and to simulate it had a pair of small tusks fastened into his mouth. Being angry, he tried to strike the natives with the tusks, and

was only prevented by considerable force. He was finally ejected, and pursued by the other angekok, who could be heard chasing the walrus several times over the iglo. A violent struggle ensued. The pursuer returned to the iglo a few minutes later with his hands and arms covered with blood, claimed to be that of the walrus spirit. The other came in, a few minutes later, quite unconcerned about the amount of blood he was supposed to have lost. The second angekok now attempted the same trick, but during the scuffle inside the iglo caught one of his tusks in a coat, which pulled it from his mouth. He immediately retired, and felt very bad about the mishap. Later he came to me and asked to be excused from working the next day, which he must spend alone appeasing his tonwak, while all his household had to fast for twenty-four hours. The final act was performed by the successful angekok, who said that he would attempt to make some angekok tobacco. While he was making his preparations a number of fresh blocks of snow were brought in, and a depression hollowed out in each for cuspidors, as no person must spit on the floor after smoking angekok tobacco. He explained that angekok tobacco tasted differently from ordinary tobacco, and that if we found this peculiar taste, of course the thing was proved. He then clumsily palmed a small piece of black tobacco between his hands, and shredded it fine, after which it was placed in a new clay pipe, lighted, and passed round the assembly.

AMUSEMENTS.

The Eskimos are firm believers in the old adage that all work and no play makes Jack a dull boy, and all join heartily in outdoor and indoor sports. Football is the popular outdoor amusement, and men, women and children join in kicking about the ice a ball of feathers or deer hair covered with deer-skin. There do not appear to be any rules, each playing for himself. There is another ball game, where the ball is batted

with the open hand backwards and forwards, the object being to prevent it from touching the ground. Wrestling is indulged in by the young men; in this no tripping is allowed, and a throw must be made from a shoulder hold. Boxing as we understand it is not practised, but they have hitting contests, where one man stands unguarded and allows another to hit him as powerful a blow as he is capable of, on the understanding that the blow may be returned under similar conditions. When such a contest takes place between strangers it often leads to the vanquished one, if at home, revenging himself upon the stranger with his knife, and altogether this is a rather dangerous pastime for grown men, although good for boys. The children play out-of-doors during the daylight, having usually miniature sleds to which they attach themselves, or the pups.

Among the indoor amusements are a number of games of skill. A very popular game is played by suspending a small ring of ivory by a string to the roof; another string, steadied by a weight, hangs below the ring, often in a vessel of water to prevent it swinging too violently. The string is twisted so that the ring revolves rapidly, and all stand round and attempt to pierce it with small wooded lances. A prize is given to the first successful one, who in turn donates a prize to the second, and so on. Another game is a variety of the cup-and-ball game. A piece of ivory, roughly carved to represent a bear or some other animal, is pierced full of holes and is attached by a short string to a small ivory pencil. The play consists in tossing the large piece into the air and piercing it with the stylus, different values being assigned to the different holes. Cat's-cradle is the constant amusement of the women and children, and they have a great number of figures unknown to the ordinary player in civilization. The Eskimos do not appear to have the gambling spirit strongly developed, and have few games of chance. One of these consists in guessing the number of articles held in the closed hand; another is played with small slabs of ivory, re-

sembling dominoes, but having a greater number of spots on them; the slabs are thrown in the air, and the number of spots are counted on the slabs that fall right side up. A circular disc of ivory, usually with sawn edges, is threaded on a loop of sinew and made to revolve in the same manner as our own small boy spins a large button.

The girls have dolls made of wood, and cleverly clothed to represent their elders. The carving of walrus ivory passes many an hour of the long winter. As a rule the carvings are rude representations of various animals and other animate objects, and have no high value as objects of art, but occasionally there arises a real artist, who when encouraged will produce wonderfully artistic models of the various animals, men, dog-sleds and almost anything suggested to him. Others are expert in making models of kyaks and hunting gear.

A common amusement, accompanied by more or less ceremony, is the sing-song. When such a performance takes place all the natives of the band congregate in one of the larger houses, sitting around on every available spot. The writer attended one of these sing-songs given in honour of some visiting natives at Cape Fullerton. The ceremony commenced by an elderly native standing out in the middle of the floor space, and beginning to hop gently about. His wife then started the song, being accompanied in the chorus by the other women of his band. The song is sung a line at a time, in a minor key, the air being confined to about three notes. After each line the chorus of two lines is sung, and is somewhat like, 'Ai yea yae yaeyaeya yae' repeated twice. While the song is in progress the man dances and hops about the floor, occasionally uttering in a loud voice, we-hew! we-hew! The song belongs to the man, and is his own composition, and is composed in a rough metre to suit the air, but does not rhyme, and no great attention is paid to the rhythm. The sentiments are at times poetic. In this particular song praise was given to the springtime, and a longing was ex-

KENIPITU BELLES AT FULLERTON.

pressed for its arrival; mention was also made of the trials of women at childbirth, and wishes were formulated for good luck to the hunters. The song continued upwards of an hour, after which one of the strangers was invited to sing, and on his taking the floor was presented by the old man with a hatchet as a mark of courtesy. The stranger was a Kenipitu from Chesterfield inlet, and as he was not accompanied by his wife he had himself to sing his song, which he did in a loud voice. The Kenipitu women of the neighbourhood loyally supported him in the chorus. He first thanked the donor of the hatchet for his magnificent present, of which he would make valuable use. He next described the country from whence he came, and said that he was acquainted with the hunting of the sea animals. He expressed a wish to be a great and successful hunter, and deprecated the waste of animals killed for food. By this time he was fairly exhausted and his voice became very hoarse. He was followed by another of the Aivillik tribe, but as there is a limit to the amount of foul air and pungent odour that a white man can stand, it was at this stage of the proceedings that the writer fled.

The songs sometimes are varied; when the singer ridicules his neighbour (and an Eskimo's joke is often much broader than it is pointed), the song is liable to breed ill-feeling; on this account the Christianized Eskimos of the east side of Hudson bay no longer indulge in this amusement, but sing hymns instead.

During the absence of the men on hunting expeditions, the women sometimes amuse themselves by a sort of female 'angekoking.' This amusement is accompanied by a number of very obscene rites, which were better left unrecorded.

GARMENTS.

The winter garments of the Eskimo are made from the skins of animals, while only those who can procure European clothing

wear anything but skins throughout the year. For winter clothing deerskin is by far the best, and is always used where it can be obtained. When this material is not available, sealskin, or the skins of foxes, wolves, bears and dogs is used, and sometimes the skins of birds. For the summer garments, sealskin is the common material, while waterproof clothing is made from the intestines of the Big seal.

The clothing of both sexes consists of a coat, breeches, stockings and boots. In the winter two suits are worn, the inner with the hair next to the body and the outer one with the hair exposed. The man's coat is usually made to descend a short distance below the hips, and is cut plain on the bottom. There are no openings in the coat, and it is drawn on over the head. It terminates above in a hood, provided with a drawing string, so that in cold weather the opening may be closed tightly about the face. The bottom is often provided with a fringe hanging several inches below the garment, and made by cutting a band of deerskin into narrow thongs. This fringe becomes entangled with the hair of the lower garment, and serves as a wind-break. The coat, or kulitang, varies somewhat in shape in the various tribes, and the style seems at times to be due to the fancy of the individual. On the east side of Hudson bay the coats are of a moderate length; among the northern Eskimo of Greenland they are quite short and barely reach the tops of the breeches when the man is standing upright, while a wide section of the back is exposed when he bends over. Along the west coast of Hudson bay, among the Aivilliks and Kenipitus, the men's coats are long, and often have a short apron and tail like those of the women. They are also ornamented by the insertion of white patches of deerskin in the backs and on the sleeves. This white skin is only worn by the women of other tribes. The inner suit is made from light summer skins, while the outer ones are heavy and thick, and are from the deer killed late in the autumn.

The breeches are made loose, and reach from the thigh to a

KENIPITU WOMAN IN WINTER DRESS.

short distance below the knee, where they are quite open to provide ventilation. They are secured to the body by a string in the waistband and have no openings.

The winter boots are usually made of the skin from the legs of the deer, carefully matched and sewn, and the feet are made with the hair inside, so that a pair of low shoes may be worn over them when travelling on the sled. Deerskin socks are worn inside the boots; they are both long and short, and are worn with the hair inside. A pair of deerskin mitts, worn with the hair outside, complete the ordinary costume of a man, but sometimes, in very cold weather, a pair of dogskin shoes are slipped over the ordinary foot-gear when travelling on the sled, as the Eskimo is very careful that his extremities are kept warm and dry.

A man's summer clothing of sealskin corresponds closely to his deerskin suit. All the garments, except the boots, are made from skins dressed with the hair on, and the hairy side is worn outside. The skins of the fœtid seal are commonly used for this purpose, and it is only a very fortunate swell who has a suit from the skins of the harbour seal. The boots are made of skins from which the hair has been shaved off. For the tops, the skin of the fœtid seal is used, the bottoms being made from the thicker skin of the big seal.

The women's clothing consists of garments similar to those worn by the men, but they are cut differently. The coat, in the body, is much looser, and the hood is larger and more open, being prolonged into the back to form a receptacle for the baby, who is carried naked there, the weight being supported by two thongs sewn to the shoulders in front and which, crossing the breast are attached under the arms. Unlike the men's coats, those of the women have an apron, reaching nearly to the knee in front, and a longer tail behind. The inner coat is often ornamented with beads or fancy strips of skin, while the outer garment is decorated with strips and patches of white

deerskin, all very neatly *appliqué*. On the east side of Hudson bay the women wear breeches and boots very similar in cut to those of the men, but on the west coast they are quite dissimilar. There the breeches are very loose, and reach almost to the ankles, where they are gathered in. Between the knee and ankle they have a curious bag on the outer side of the leg, which is used for their feet when seated within the snow-houses, the footwear being removed and the feet withdrawn inside the breeches and thrust into these bags—a very comfortable plan. With such long and clumsy looking breeches, short shoes and socks must be worn.

The women arrange their hair in different fashions, often attempting to follow those set by their more civilized sisters of the trading stations. For example, the prevailing fashion on the east side of Hudson bay is to wear the hair cut short, like that of the wife of the officer of the Hudson's Bay Company at Great Whale river. About Cumberland gulf the hair is usually put up in a knot on the back of the head, and this is sometimes varied by small side knots over the ears. Among the Aivilliks and Kenipitus, the prevailing fashion is two rolled braids wound with string or ribbon, one over each ear. The hair when dressed for native state occasions is separated into two side locks, each of which is covered by a highly ornamented covering sewn with beads, and worn as long cylinders hanging down over the breasts.

The children's clothing, when they wear any, is very similar to that of the grown people, except that the girls, until they are nearly mature, are not provided with tailed coats. Infants are carried perfectly naked in their mother's hoods until they are about two years old.

MORAL CHARACTERISTICS.

The Eskimo as a rule is strictly honest, and the occasional thief is looked down upon by the wild native as well as by the

partly civilized one. Not quite as truthful as they are honest, they still compare favourably in that respect with the white men. When the source of a lie is traced it is found to be due to a mistaken politeness, the native intending to please by answering in a manner which he thinks will be agreeable to the questioner. Another cause is due to the etiquette of the people, whereby a man always belittles his success in hunting or other actions. When these reasons are unknown to the casual stranger among these people he classes them as liars, when the case is not so, for an Eskimo seldom, or never, makes a false statement to shield himself from the consequences of ill-doing. Of course there are black sheep in every flock, and the Eskimos have their share of them.

Judged by the standards of sexual morals of civilization, the Eskimo is a minus quantity; but who is to say what is right in this respect among a people situated as they are.

In temperament they are phlegmatic and slow to anger, being good-natured rather than otherwise, but like all savages, liable to ungovernable bursts of rage when roused. As a rule they are proud and independent, with a greater sense of gratitude for favours received than their Indian neighbours.

They are not cleanly in their habits, and this is not surprising considering that for the greater part of the year they must melt all the water they use. The length of time required for the decay of animal matter in the cool northern regions renders personal or culinary cleanliness a matter of sentiment and not of health, and they do not pay great attention to sentiment.

Being accustomed from childhood to the strong odours of seal blubber and rancid meat, they are not at all delicate in their senses of taste and smell, and it occasionally happens that their liking for tainted meat ends disastrously, especially when a rotten porpoise furnishes the food. The writer knows of several deaths due to poisoning from this cause.

As a people, they are very hospitable and kind; but like other savages would probably soon tire of continuous efforts to support helpless whites cast upon them, especially when the guests assume a superiority over their hosts.

Upper Encampment, Chesterfield Inlet.

CHAPTER VIII.

GEOLOGY.

The following summary of the geology of the northeastern coast of America and of the Arctic islands is based, so far as the southern and eastern portions of that region are concerned, upon the observations made on the cruise of the *Neptune,* and is supplemented by the reports of previous explorers in the areas beyond the limit of the voyage of that vessel. The geological work of the Arctic explorers until recent years was necessarily poor and disconnected owing to the absence of

trained men, and to such work being of secondary importance among the objects of the expeditions.

The observations of these earlier explorers were carefully gathered from the different narratives, and ably summarized by Dr. G. M. Dawson in a report on the Geology of the Northern Portion of the Dominion of Canada, published in 1886. This work has been largely followed in the present report, but such corrections have been made as are justified by the knowledge gained in explorations since the date of its publication.

The notes on the geology of the southern part of Baffin island are from the observations of Dr. R. Bell, while those on Ellesmere island and the Sverdrup islands are based on the work of P. Schei, the geologist of the *Fram*.

The rocks of the Arctic islands and of the northern coasts of the continent present an almost continuous ascending series from the Archæan to the Tertiary, while the upper loose material represents various phases of the Glacial age and of the subsequent Post-Glacial deposits.

Only isolated attempts have been made to subdivide the Archæan complex into Laurentian, Huronian and other members of the system. This lack of subdivision is due to want of detailed knowledge; not to the absence of the various members of the complex in these northern regions, where the greater number of the members are known to occur.

The Palæozoic rocks are well represented on the islands by thick deposits extending upwards in a continuous series from the Cambro-Silurian to the upper beds of the Carboniferous. Rocks older than the Galena-Trenton are only found in the northern part of Ellesmere island, where a series of beds appears to connect the Upper Huronian formations with the lower members of the Cambro-Silurian.

Mesozoic rocks are found on the northern Parry islands, on the Sverdrup group and on the western and northern sides of Ellesmere island.

Tertiary formations occur on the northwestern islands, on the northern part of Ellesmere, as well as on the northern and eastern parts of Baffin island.

The former presence of a continental ice-cap is attested along the northwestern shores of Hudson bay and in the southern part of Baffin island, by the rounded and polished rock surfaces, which are everywhere well marked by the ice striae, often in several sets showing changes in the direction of the ice movement. On the east side of Baffin the rock surfaces show signs of rounding and smoothing by ice, but the striae are not well marked, and the glaciation does not appear to have been nearly so intense as to the south and westward. Passing northward up the western side of Davis strait and Baffin bay the evidence of intense glaciation becomes less and less, that on Ellesmere the present condition of the local ice-covering would appear to represent nearly as great an amount of glaciation as ever occurred there.

The sequence of earth movements and physical conditions, read from the geological formations of the northeast, are as follows: An ancient floor of crystalline rocks, largely of igneous origin, represents the most ancient crust of the earth. These, associated with ancient bedded deposits and cut by dark basic intrusions of trap and allied rocks, were at a very early period so crushed and foliated that it is now impossible to separate them. Upon this ancient complex was laid down a series of bedded deposits, chiefly sandstones and dolomites, associated with contemporaneous traps, as may be seen along both the shores of Smith sound. Following this came a great outburst of granite and other acidic igneous rocks which, over large areas, inclosed, penetrated, compressed and otherwise altered the sedimentary deposits to such an extent that it is now impossible to separate them from the older complex upon which they were originally deposited. Only in a few comparatively small areas were the conditions of the granite intrusion such as to

allow the sedimentary deposits to preserve their original unaltered conditions. All the above rocks are grouped in the Archæan, and further and closer examination will probably show that it contains all the members of the Laurentian and Huronian found in the more southern Archæan regions of Canada.

Except in the northern part of Ellesmere, there is a considerable time-break in the geological sequence in the northeast between the Archæan rocks and the Cambro-Silurian strata which rest unconformably upon them. Schei found at Bache peninsula, on the eastern side of Ellesmere, a series of stratified sedimentary rocks resting upon the northern flank of the Archæan and containing fossils of Cambrian age. These deposits have a thickness of nearly 1,500 feet, and are overlaid by limestones containing Cambro-Silurian fossils.

The Archæan rocks at the time of deposition of the lower beds of the Cambro-Silurian limestones appear to have extended southward from the vicinity of Bache peninsula in a gradually widening ridge along the western side of Baffin bay and Davis strait. In this manner they attained a width of seventy miles on the southern side of North Devon, and occupied the entire southern shore of Baffin island, being separated from the great area of Labrador by the depression of Hudson strait, which probably existed at that early period. Islands of Archæan rocks may also have risen above the surface of the Cambro-Silurian sea in the present island of North Somerset and on Melville and Boothia peninsulas, as well as on other portions of the northern coasts of the mainland, to the west of Hudson bay.

The western Cambro-Silurian sea filled the present depression of Hudson bay, and extended far to the south and westward of its present limits, outliers of limestone containing fossils of this age, and very similar in mineral character, being found in the valleys of the great lakes of Manitoba. From Manitoba these rocks have been traced southward into the United States,

so that at the time of their deposition the Cambro-Silurian sea occupied a great basin open to the Arctic ocean and extending southward into the middle of the continent.

This was the time of maximum encroachment of the northern ocean, after which the land gradually rose, and the sea slowly receded. Owing to the great lapse of time and the eroding of the thick ice-cap in the more southern regions, it is exceedingly difficult to now trace the boundaries of the narrowing sea during Silurian and Devonian times. Cambro-Silurian limestones containing fossils which refer them to the Galena-Trenton, are widespread over the northern islands and in a wide margin along the western and southern shores of Hudson bay. Outliers of these rocks occur at the head of Frobisher bay in the southwest part of Baffin island and on Akpatok island in Ungava bay. As before stated, similar limestones are found in the lake valleys of Manitoba, and it is quite possible that these limestones were once continuous with those of Hudson bay, the present break having been caused by the erosion of the glacier.

The upward continuation of these limestones containing Silurian fossils occupies a corresponding but slightly circumscribed area. These Silurian limestones form the characteristic abrupt cliffs of the islands on both sides of Lancaster sound, and continuing southward occupy the larger parts of Southampton, Coats and Mansfield islands in Hudson bay, as well as the low lands of the western part of Baffin island. They are not well marked, and are probably considerably thinner on the western side of Hudson bay, but are found in the Winnipeg basin.

The Devonian gradually emerges from the Silurian in the cliffs of the islands to the north of Lancaster sound, and forms the lower parts of the cliffs of the southern side of Ellesmere. Devonian fossils are not found in the limestones of the islands of Hudson bay, and only occur in a narrow belt on the low lands

to the west and southwest of James bay. Similar rocks form the upper beds of the Winnipeg basin.

There is no break in the passage from Devonian to Carboniferous in the rocks forming the Parry islands and the southern part of Ellesmere, where Carboniferous rocks occupy wide areas on these northern islands, but are not found to the southward of Lancaster sound, showing that the Palæozoic sea had retreated that far north before the close of the Devonian.

The land rose above the ocean at the close of the Carboniferous, and with the exception of the northern parts of the Parry islands, the Sverdrup group and the western part of Ellesmere has not been deeply submerged since. Rocks of Mesozoic age, belonging to the Alpine Triassic, have been found in the last-named places, but in no other localities to the southward within the limits of this report.

Considerable earth movements occurred at the close of the Mesozoic period, causing those and older rocks to be highly tilted and folded.

Another slight submergence took place in the Miocene Tertiary, when shallow water deposits of sand, gravel and clay, associated with beds of lignite, were laid down in the wide valleys along the margins of several of the Arctic islands. Such deposits are known to exist in Banks island, on the western side of Ellesmere and along the northern and eastern sides of Baffin island. There is little doubt that other deposits of this age will be discovered when more systematic search has been made for them in these northern regions. From the character of the fossil plants found in these deposits there can be little doubt that during the Miocene the climate of these northern islands was much warmer than at present, and approached a tropical condition.

The conditions of the land and water surfaces during the Glacial period differed little from those at present, except that

there has been a considerable uplift of the land, as proved by the marine terraces found along the coasts. The maximum uplift probably amounted to 700 feet along the eastern side of Baffin island, and was perhaps slightly less on the islands farther north, where Schei reports beaches 600 feet and upwards above the present sea level. This being the case, a new explanation must be found for the depression and subsequent uplift of the land covered by ice, if the uplift be practically the same in northern Ellesmere, where the accumulation of ice is nearly as great to-day as at any previous time, while in the southern part of Baffin island a great thickness of ice was present during the Glacial period and has now completely disappeared. Perhaps we have been taking cause for effect, and the uplift due to some unknown cause may have been the cause of a lessening of the ice; certainly the almost equal rise of the land throughout the Arctic islands is an argument against the subsidence of the northern lands being due to the burden of the ice-cap, and the subsequent uplift due to the disappearance of that burden.

DETAILS OF THE GEOLOGY BY ISLAND GROUPS.

It is exceedingly difficult to write a readable, concise and comprehensive account of the geology of the territory included in this report without subdividing it in some manner. This has been attempted by considering the different formations under their separate headings, and dividing the territory, as has been done in the geographical description, into groups of islands, and considering each of the great geological divisions separately.

ARCHÆAN.

Hudson Bay and Hudson Strait.

The territory comprised in this group includes the islands of Southampton, Coats, Nottingham, Salisbury, Charles and Resolution, along with the shores of the northwest part of Hudson bay, and the south shore of Hudson strait.

The geological information concerning this group obtained prior to the present voyage is contained in the reports of Dr. Bell, Tyrrell and the writer.

Crystalline gneisses, schists and granites occupy the eastern and northern parts of Southampton, extending northward from Seahorse point to Frozen strait at the northern end of the island. The rocks near the junction of the Archæan with the Silurian at Seahorse point are largely a very quartzose, light-gray mica-gneiss, associated with bands of rusty-weathering, fine-grained mica-gneiss holding graphite in small flakes, the rusty colour being due to the decomposition of small grains of pyrite disseminated through the rock. This rusty gneiss closely resembles that found in the vicinity of Cape Wolstenholme at the entrance to Hudson strait, and both appear to be similar to the sillimanite gneiss of the Grenville series of southern Canada. Both of the above rocks are cut and twisted by masses of a coarser granite-gneiss pink to red in colour, with pearly feldspar and smoky quartz. All are cut by dikes of feldspathic pegmatite containing much of the pearly feldspar.

The only notes relating to the Archæan area to the north of Seahorse point are those of Parry and Back, both of whom mention the occurrence of granites and crystalline rocks in several places to the northward.

The band of Archæan rocks which crosses the eastern part of Coats island has never been examined closely, and our knowledge of it is confined to observations made from the ship in passing.

The high rocky shores of the eastern and northern sides of Salisbury island were closely followed by the *Neptune,* so that the red, crystalline rocks forming its cliffs could easily be seen. The prevailing rock was red, or pink, and only occasionally were darker masses seen.

Nottingham, which lies south of Salisbury in the western part of Hudson strait, was visited by Dr. Bell in 1884 and 1885, when he examined the rocks in the neighbourhood of Port De Boucherville, in its southeast part, and he there found along with the common varieties of gneiss a number of patches of fine-grained red syenite.

Charles island is wholly formed of Archæan gneisses. The prevailing rock in the western part is a fine-grained light-gray, or pink mica-gneiss, associated with medium to coarse-grained mica-hornblende granite-gneiss; the latter cutting and altering the light-coloured gneisses.

Resolution island has never been visited by a geologist, and consequently its rocks can only be described from observations made while passing it in the ships. The rocks everywhere appear to be crystalline Archæan, a red variety predominating.

The southern shores of Hudson strait from Douglas harbour to the mouth of George river in the southeast part of Ungava bay were examined by the writer in 1897, and a detailed statement concerning them is given in the report of that year. The remaining portions of this side of Hudson strait were examined on the voyage of the *Neptune,* the part westward from Douglas harbour to Cape Wolstenholme while sketching the coast-line from the ship, and the greater part of that between Cape Chidley and the mouth of George river by Mr. Caldwell in a boat during the absence of the *Neptune* to the north in 1904. These examinations connect with the work of the writer beyond Cape Wolstenholme, and thus practically finish the examination of the north and west sides of the Labrador peninsula.

The rocks of the south coast of the strait westward from Cape Chidley, as examined by Mr. Caldwell, show that large masses of red and pink mica and mica-hornblende-granite, in a more or less foliated condition, occupy the greater part of the coast area. These granites are newer than the other crystalline rocks associated with them, which they have inclosed and altered. The older rocks are largely of basic igneous origin, and vary in composition from anorthosites almost free from bisilicates, to hornblendic and chloritic schists containing very little feldspar. A series of light-coloured, high quartzose gneisses is also found, and probably represents altered bedded rocks associated with the basic igneous ones.

The basic rocks and the light-coloured gneisses are penetrated by many large dikes of pegmatite from the granites. In many places these dikes are very quartzose, and where they cut the basic masses often contain pyrite and give indications of other minerals. Associated with the lighter gneisses are large long masses of rock, which carry in places considerable quantities of graphite, in others an impure iron ore. The study of these bands has not been sufficient to pronounce as to whether they are veins or beds.

Ancient crystalline rocks occupy the entire coast-line from the mouth of George river at Ungava bay to Cape Wolstenholme at the eastern entrance to the strait. Mica-granite and, in less quantities, mica-hornblende granite, both more or less foliated, occur along the greater length of this coast. In many places these granites are associated with other gneisses, which are usually lighter in colour, finer in texture, and contain more quartz than the eruptive granite. These lighter gneisses usually are garnet-bearing, the crystals of that mineral being often of large size. In a greater number of places the gneisses of these two series are so closely mingled as to render a separation impossible; but there are localities, notably along the west side of

Ungava bay, where such a separation can be made, and the lighter coloured gneisses are seen to be cut and foliated by the intrusion of the coarser and garnet-free granite-gneisses. At the mouth of Payne river and about the mouth of Hopes Advance bay the change from unaltered clastic rocks to the light-coloured gneisses is plainly seen in a number of places. The unaltered series consists of impure dolomites, sandstones, cherts and bedded iron ores similar to the series of rocks found in the central parts of Labrador and along the east coast of Hudson bay. This series bears a close resemblance to the iron-bearing rocks of Lake Superior, and there is little doubt that they are of the same age. In former reports they have been termed so-called Cambrian, but by the new classification they represent one or more members of the Huronian. These rocks are associated, as elsewhere, with great outbursts of basic igneous matter in the form of sills, dikes and irregular masses. Where the newer granites have cut and inclosed masses of this series, the different rocks forming it are seen to have undergone considerable alteration. The bedding has been disturbed, so that the strata lie at angles approaching the vertical, and have been broken, and minutely penetrated by quartzose injections, both along and across the bedding planes. Foliation and schistosity have been induced, and the arrangement of the chemical constituents has been altered so that new minerals are formed. The impure cherty limestone is changed to hornblendic schists, the impure sandstone and quartzite to garnet-bearing quartzose gneisses, and the cherty iron ores to a gneissic rock consisting of layers of quartz and specular iron.

An examination of a number of the contacts between the granites and the Huronian rocks shows an alteration, from a slight crumpling and baking to highly tilted and contorted crystalline schist and gneiss. The accompanying basic igneous rocks, originally fine-grained traps or diabase, are changed in

like manner to strongly foliated hornblendic and chloritic schists, usually freely penetrated by quartz veins holding quantities of pyrite and other minerals.

In passing westward from Ungava bay the granite predominates along the coast, and the areas of the altered bedded rocks and their accompanying traps are much smaller, and are so intimately intruded by the granite that it is very difficult to separate them. The gneisses of the altered Huronian rocks can only be guessed at, by their texture, light colour and the presence of garnet in them. The ancient traps and greenstone masses are more easily separated from the complex, but they are so penetrated by the granites that it is impossible to trace them except on a large scale detailed map, which would require many years' work to complete.

Large masses of these basic rocks occur along the coast in several places between Cape Hopes Advance and Douglas harbour, most noticeably about Wakeham and Fisher bays, where quartz veins are numerous, and carry considerable quantities of sulphides.

The examination of the coast to the westward of Douglas harbour was only such as could be made from the ship, and lacks all the detail of the eastern portion. Red granite gneisses appear to occupy the greater portion of the coast, with areas of dark basic rocks at intervals. At Sugluk bay, where a closer examination was made, a medium to coarse-grained pink to red mica and mica-hornblende granite-gneiss was most abundant. This granite inclosed bands of a lighter coloured quartzose-gneiss, and also intruded large masses of dark-green altered diabase.

The granite-gneisses occupy the coast to within a few miles of Cape Wolstenholme, when the prevailing rock is a rusty fine-grained sillimanite-gneiss containing scales of graphite and considerable pyrite in small grains disseminated through the rock.

These dark gneisses are inclosed and penetrated by the granite-gneisses, and probably represent portions of the ancient bedded series.

Beyond Cape Wolstenholme, gneisses occupy the eastern coast of Hudson bay to within a short distance of Cape Smith, where a high ridge of trap runs inland in a northeast direction and has a width of several miles. Further south the gneisses again predominate along the coast to the Portland promontory in latitude 58° N.

GEOLOGY OF THE NORTHWEST SHORES OF HUDSON BAY.

The following account of the geology of the northwest shores of Hudson bay has been compiled from observations made during the trip of the launch from Winchester inlet to Chesterfield inlet in September, 1903. These are supplemented by the notes made in May, 1904, while making a track survey from Cape Fullerton to the entrance of Chesterfield inlet. The observations to the north of Fullerton were made by Mr. Caldwell, in April and May, 1904, while on his surveying trip to the head of Wager inlet; to these are added observations by the writer made on a boat trip along the coast later in that spring, on the way to and from Southampton island, when the rocks of the mainland were examined as far north as Yellow bluff.

The rocks seen along the shore between Chesterfield and Winchester inlets are largely a flesh-red to pink mica-hornblende granite-gneiss, often only slightly foliated, and varying in texture from medium to coarse-grained. These are associated with broken bands of dark-gray or red gneisses, usually very quartzose, and containing a considerable quantity of mica and hornblende, the latter often partly decomposed to chlorite. These gneisses have evidently been cut and broken by the intrusion of the granite-gneisses. Many veins of pegmatite cut all these rocks; it consists chiefly of red or violet feldspar with much quartz, and in some places large crystals of black hornblende.

The granite-gneisses are also most abundant inland, as was seen along the lower part of Chesterfield inlet and in the country forty miles inland from Winchester inlet.

The granites occupy the shores and islands between Winchester inlet and the west side of Island bay, about half way to Fullerton, when they give place abruptly to a series of dark schists. These schists are largely micaceous, but there are also frequent bands containing considerable quantities of hornblende, and these are more basic than the more common mica-schists, which always contain quartz in varying amounts. These mica-schists appear to have been clastic rocks associated with bands of trap, all having been altered and foliated by the granite intrusion. The schists are very regular, and have a constant strike of N. 10° W. Many of the basic bands contain varying quantities of pyrite, but it was never seen in sufficient abundance to constitute a mine. All the schists carry dark-red garnets, some of which are regular in their crystallization and of good size.

The islands about Fullerton harbour are formed partly of granite and partly of these dark schists. On this eastern contact of the granite with the area of schistose rocks, the latter have been greatly disturbed by the intrusion, being squeezed, contorted and broken by granite masses, as may be seen from the illustration. Areas of coarser basic rocks now occur in the rocks along the coast, usually in the form of coarse gabbro, but often in a more altered condition as coarse hornblende-gneisses. The granites are the prevailing rocks along the coast as far north as the mouth of Wager inlet, and have generally a red or pink colour. Associated with them and evidently altered by their intrusion are patches of gray quartzose gneiss, and less frequently areas of old basic intrusive rocks.

At Whale point, where the rocks were closely examined, the oldest rock was represented by a medium to fine-grained, gray

Contorted Gneiss and Granite at Fullerton.

and pink, very quartzose gneiss. This had been cut by a coarse diabase, and both had been foliated and broken by the intrusion of the newer granite. Dikes of a newer diabase cut all the other rocks.

The granites prevail about Wager inlet, but there are more and larger areas of the dark basic rocks about that great bay than to the southward, making it a more promising field for economic minerals, especially as these basic rocks generally carry sulphides, and Rae reported free gold to have been found about the head of the inlet.

All the geological information concerning the western coast of Hudson bay to the northward of Wager inlet is contained in the narratives of the voyages of Parry and Dr. Rae. The explorations of Rae ended at Repulse bay. He reported only Laurentian rocks along the coast, with granite-gneisses predominating, these being accompanied by considerable areas of greenstones, showing the rocks in the northern part to be very like those along the southern shores of Roes Welcome.

Parry explored the west side of Fox channel from Frozen strait to Fury and Hecla strait. The result of his observations has been summarized by Dr. Dawson as follows: ‘ The geological specimens brought back were examined by Prof. Jameson, and the detailed maps of the expedition include indications of the character of the rock at so many places, as to afford the means of tracing the geological outlines with very considerable accuracy. Granitic and gneissic rocks occupy the whole of the southern part of the east shore of Melville peninsula, and are continued northward behind a low track of limestone country, forming a range of mountains in the centre of the peninsula to Hecla and Fury strait. They also form the south shore of this strait, and most of the islands in it, and apparently the whole eastern shore of the adjacent south part of Cockburn “ island.”

‘ The rocks referred above, in a general way, to the Archæan,

probably include areas of Huronian. Jameson mentions as among the prominent varieties of rocks derived from this region, "Granite, gneiss, mica-slate, clay-slate, chlorite-slate, primitive-trap, serpentine, limestone and porphyry." In association with these the following minerals occur: "Zircon and beryl, also precious garnet, actinolite, tremolite, diallage, coccolite, rock crystal, calc-spar, rhomb-spar, asbestos, graphite or black lead, specular iron ore, magnetic iron ore, chromic ore or chromate of iron, titanic iron, common and magnetic iron pyrites." Some of the "transition rocks" noticed by Jameson should probably also be classed with the Archæan, and in addition to several of the minerals above mentioned, in these were found tourmaline (schorl) and molybdenite.'

The coast between the mouth of Chesterfield inlet and Churchill, was examined by Tyrrell, and the following summary of the geology is taken from his report:—

'On the low flat shores of Hudson bay between Seal river and Cape Esquimaux few rock exposures occur, but those seen consisted of granites and gneisses of typical Laurentian aspect. For forty miles north of Cape Esquimaux no rock in place was seen, and thence northward to Baird bay some of the points consisted of granite and gneiss, though the shore generally consisted of Huronian rocks.'

'The largest area of Huronian rocks found in this district extends more or less continuously for 120 miles along the west coast of Hudson bay, from near Baker's foreland to a point 45 miles north of Cape Esquimaux.'

'The rocks constituting this system may be divided into three more or less distinct groups, viz.: The Marble island quartzites, the greenish quartzites and graywackes, and the more or less highly altered, and often schistose diabases and gabbros.'

'The Marble island quartzites are composed of hard white quartzite, consisting of more or less rounded grains of quartz,

of moderately regular size, cemented together by interstitial silica. They are very distinctly bedded in thick and thin beds, and the surfaces of the beds are often covered with beautiful ripple-markings. The heavier beds also often show distinct false bedding. They are usually in a more or less inclined attitude, but they were nowhere seen to be very much crumpled or squeezed into minute folds. Their total thickness was not determined.'

'These quartzites were first noted by Dr. Bell from Marble island, and although this island was not examined by the writer, rocks of undoubtedly similar character to those described by Dr. Bell, were seen in many places along the shore, and consequently the name is here retained.'

'In one place near the *cache* on the west side of Hudson bay, a thickness of sixty feet of this quartzite, in a nearly vertical attitude, was seen almost in contact with the Laurentian gneiss, there being but a narrow, drift-filled gap between the two. This would indicate either the existence of a fault, or that here the quartzites are the base of the Huronian, or that the gneiss represents an eruptive rock which has risen through or into the Huronian subsequent to the deposition of the quartzite.'

'Dark-green eruptive rocks, chiefly diabases, often very much squeezed and altered, are largely developed in the Huronian, composing a considerable proportion of the rocks of this system. On the west coast of Hudson bay these rocks are cut by many veins of white quartz, highly charged with iron and copper-pyrite.'

'Associated with the massive diabases, and often indistinguishable from them except on close examination, are many beds of fine-grained, often schistose graywacke, or greenish quartzite, which appear to have been caught up in, or surrounded by the eruptive rocks.'

GEOLOGY OF ISLAND GROUP II.

This group is comprised of the great island of Baffin, with Bylot island lying off its northeast corner, and the many smaller islands which lie as a fringe around both.

Geological specimens from the east side of Baffin were collected by the expedition under Ross and Parry, and were described by Dr. McCulloch. They consisted of loose specimens collected in two localities, and give little information. Specimens collected by Parry on the same coast were described by Koning as gneiss and micaceous quartz rock, also some ambiguous granitic compound in which hornblende seems to enter as a subordinate ingredient.

Dr. P. C. Sutherland, in 1853, describes the east coast of Baffin island between Lancaster sound and Cumberland gulf as follows: 'On the opposite shore (south) of Lancaster sound, at Cape Walter Bathurst, the crystalline rocks are again recognized, and from this point they occupy the whole coast south to Cumberland strait and probably considerably beyond it. To this, however, I believe there is one exception, at Cape Durban, on the 67th parallel, where coal has been found by whalers; and also at Kingaite, two degrees to the southwest of Durban, where from the appearance of the land as viewed from a distance, trap may be said to occur on both sides of the inlet. Graphite is found abundant and pure in several islands situated on the 65th parallel of latitude, in Cumberland strait, and on the west side of Davis strait.'

C. F. Hall brought home a considerable collection of rocks and minerals picked up during his explorations about Frobisher bay and the southeast coast of Baffin island. These were named by Prof. B. K. Emerson, and consist of ordinary Laurentian rocks, including granite, gneiss and schists. The minerals were magnetite, apatite, bornite and pyrite from Frobisher and Cyrus Field bays. Lower Silurian limestones were found in a

small outlier at Silliman's Fossil Mount near the head of Frobisher bay. This locality was visited in 1897 by a party from the Peary Arctic expedition of that year. In the course of a few hours they obtained fifty-four species of fossils from this locality, which were later named by C. Schuchert.

Dr. Franz Boas describes the nucleus of the mountain masses of Baffin island to be everywhere gneiss and granite, with Silurian limestones about the region of the large lakes of the interior and along the low lands of the west coast.

Dr. R. Bell visited the north shores of Hudson strait in 1884 and 1885, and again in 1897, when he made a close examination of the coast from the neighbourhood of Big island to Chorkbak inlet near Gordon bay. Dr. Bell describes the prevailing rocks of the southern shore of Baffin island as consisting of well stratified hornblende and mica-gneiss, mostly gray in colour, but sometimes reddish, interstratified with great bands of crystalline limestones, parallel to one another and conformable to the strike of the gneiss, which in a general way may be said to be parallel to the coast in the above distance. The direction, however, varies somewhat in different sections of the coast.

'The distinguishing feature in the geology of the southern part of Baffin land is the great abundance, thickness and regularity of the limestones associated with the gneisses. At least ten immense beds, as shown on the accompanying map, were recognized, and it is probable that the two others, discovered in North bay, are distinct from any of these. There would, therefore, appear to be twelve principal bands as far as known, to say nothing of numerous minor ones, between Icy cape and Chorkbak inlet. The limestones are for the most part nearly white, coarsely crystalline, and mixed with whitish feldspar. ——— The limestones usually contain scattered grains of graphite, and among the other minerals which commonly occur in the various bands are mica, garnet, magnetite, pyrite and hornblende.'

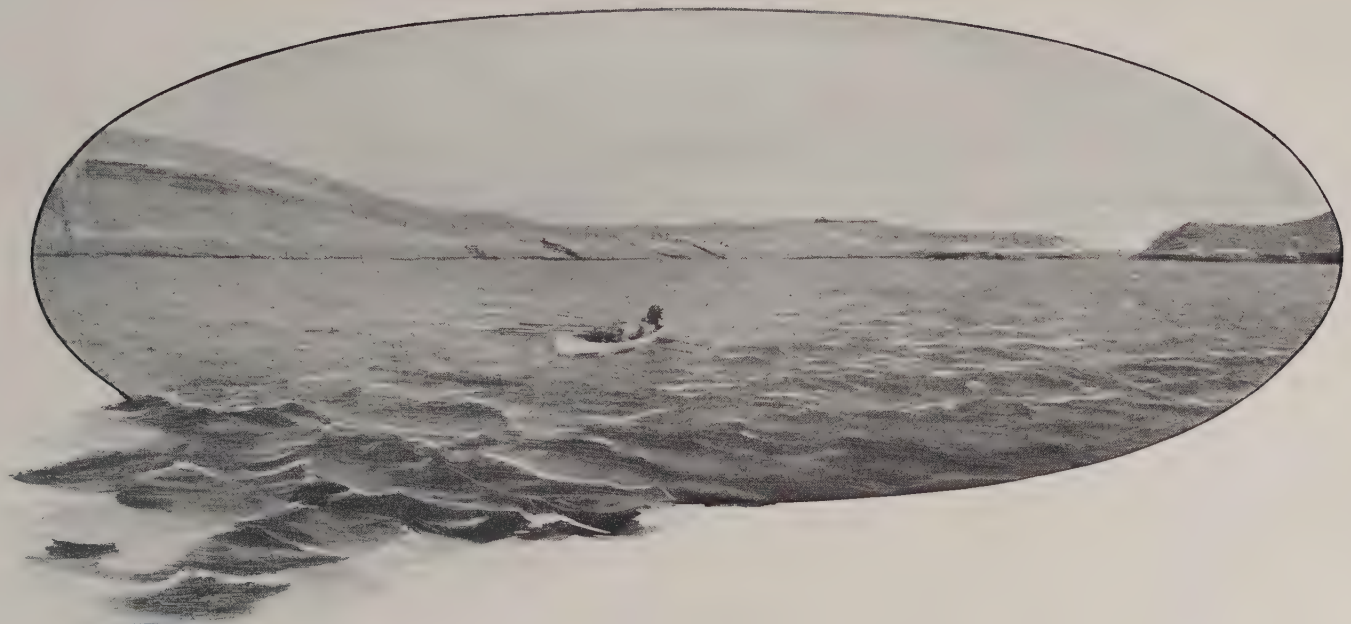
'Although white is the prevailing colour of these limestones, this, in some localities, is replaced by light-gray and occasionally by mottled varieties.'

'The limestone bands have not suffered greater denudation than the gneisses, and they form hill and dale alternately with the latter.——— Owing to the scantiness of vegetation in Baffin land, the white colour of the limestones on the sides and tops of the hills and ridges renders them very conspicuous in the landscape. Seen from a hill-top at a distance of fifteen or twenty miles, they might be taken for glaciers.'

'As to the total thickness of the twelve bands of crystalline limestone which have been mentioned as occurring in this part of Baffin land, the available data on the subject are not sufficient to form a correct estimate, but on adding together their probable approximate widths it seems to be no exaggeration to place their possible total volume, great as it may appear, at about 30,000 feet, or on an average of 2,500 feet for each of the principal bands, taking no account at all of the smaller ones.'

From his observations made along the coast to the eastward of Big island in 1885, and from the finding of crystalline limestone fragments by Hall in Frobisher bay, Dr. Bell concludes that the crystalline limestones extend eastward to Resolution island, giving a very extensive development of the Grenville series of the Laurentian in the southern part of Baffin island.

At present we know that the limestones of the typical Grenville series are only the highly crystalline equivalents of some of the Huronian limestones. This probably is the case in Baffin island, where these rocks with some of the accompanying gneisses represent a highly metamorphic phase of portions of the Huronian, while other of the gneisses are the foliated state of the granite masses which caused the alteration of the limestones. This would correlate the rocks on the north side of Hudson strait with the altered Huronian rocks of northern Labrador, where in places similar crystalline limestones occur.



BOSTON
PUBLIC
LIBRARY

Cape Haven Harbour.

The Huronian rocks of Labrador are marked by the number of repetitions of the strata caused by thrust faults in all the areas examined, and this repetition of measures by similar faults may account for the number of bands of limestone found in the southern part of Baffin island.

The crystalline rocks appear to form the southwest coast of Baffin island for some distance beyond King cape on the east side of Fox channel, when they give place to a wide area of low lands extending nearly to the head of Fox channel, where the crystalline rocks again form the higher lands to the north and east of Fury and Hecla strait.

On the late voyage of the *Neptune* the rocks of the east side of Baffin island were examined at Ponds inlet, on the islands on both sides of Cumberland gulf, and at Cape Haven and Frenchmans cove on Cyrus Field bay. In other places the ship passed sufficiently near the shores to allow of a good idea being formed of the rocks by the aid of powerful glasses.

Examinations of the rocks were made at Button point, the southeast part of Bylot island, on the north side of the entrance to Ponds inlet; also in the vicinity of Salmon river some thirty miles up the inlet and on its south side, and at Erik harbour on the same side near the mouth of the inlet. At all these places typical Laurentian gneisses and schists were obtained. Among the specimens brought home from these localities is a light-coloured coarse-grained augen-gneiss consisting largely of white and pink feldspar, with thin bands of biotite and little quartz. Another seeming variety of this rock is a well-banded fine-grained mica-gneiss composed of pink and white bands of feldspar separated by thin bands of mica. Associated with these are bands of very quartzose gneiss varying in colour from light to dark from the varying proportions of mica present. These gneisses are usually found containing a considerable number of dark-red garnets; and they probably represent a metamorphic

series. A fine to medium-grained rock, usually somewhat foliated, and composed largely of dark-red feldspar with much mica, little hornblende and quartz, cuts the foregoing gneisses, and probably was the granite which altered them by intrusion to their present state. The basic intrusive rocks are represented by dark-green diabase, or its alteration products, dark hornblendic and chloritic schists and gneisses. Taken as a whole, this series of specimens would answer for any of the typical Laurentian regions of northern Canada.

At Cumberland gulf the rocks were examined at Kaxodluin on the south shore, some twenty miles from Blacklead station; also at Blacklead and at Kekerten islands. At Kaxodliun light and dark-coloured mica schists and gneisses were found, cut by a light-pink mica-granite-gneiss. The dark schistose rocks were decomposed near the surface, and contained a considerable amount of disseminated pyrite. Between this place and Blacklead the ship followed the shore-line closely, so that the prevailing dark, rusty gneisses were distinctly seen.

The most abundant rock on Blacklead island is a coarse-grained, pink mica-granite-gneiss, containing large feldspar crystals. This cuts, and is foliated with, coarse, dark mica-schists, and finer-grained lighter-coloured quartzose gneisses. Some of the dark schists contain flakes of graphite, and this mineral is said to be abundant in places on the islands and shores of the gulf farther to the westward, where attempts have been made to work some of the mica and graphite deposits, without much success.

At Kekerten similar gneisses are found, along with large masses of diabase and greenstone, somewhat decomposed near the surface, where it weathers reddish.

At Frenchman cove at the head of Cyrus Field bay, the prevailing rock is a coarse-grained, red mica-granite-gneiss, associated with bands of coarse mica-schist.

At Cape Haven station near the northern entrance to the bay, pink and gray mica-gneiss prevails, and is cut by many large dikes of red pegmatite composed largely of perthite, with some quartz and mica. Schists forming one of the islands of the harbour contain any well-developed crystals of pyrite, up to an inch cube.

The northern and eastern sides of Bylot island appear to be wholly formed of crystalline rocks, without any of the capping limestones found upon the other islands of Lancaster sound.

ISLANDS OF GROUP III.

This group contains the large islands of Bank, Victoria, Prince of Wales, North Somerset and King William, all situated south of Lancaster sound and west of Prince Regent inlet. North Somerset alone was visited by the *Neptune;* all geological information concerning the others being from the observations made by the several parties engaged in the search for the Franklin expedition.

Dr. G. M. Dawson collected this information from the narratives of these search expeditions, and printed a concise summary of it in his report on the northern portions of the Dominion, from which the following notes have been taken:—

'Archæan rocks are found only on Prince of Wales and North Somerset islands, where a spur from the great mass of crystalline rocks forming the northeastern mainland extends northward through the peninsula of Boothia and forms the land on both sides of Peel sound.

'The granitoid rocks are again found on the west side of North Somerset, where they form the eastern boundary of Peel sound. Boulders of the granite are found at a considerable distance (100 miles) to the northeastward of the rock *in situ,* as at Port Leopold, Cape Rennell, &c. The general characters of the granitic rocks in the north and west of North Somerset are

thus described by Capt. M'Clintock: "Near Cape Rennell we passed a very remarkable rounded boulder of gneiss or granite; it was six yards in circumference, and stood near the beach, and some fifteen or twenty yards above it; one or two masses of rounded gneiss, although very much smaller, had arrested our attention at Port Leopold, as then we knew of no such formation nearer than Cape Warrender, 130 miles to the northeast; subsequently we found it to commence *in situ* at Cape Granite, nearly 100 miles to the southwest of Port Leopold. The granite of Cape Warrender differs considerably from that of North Somerset, the former being a graphic granite, composed of gray quartz and white feldspar, the quartz predominating, while the latter, a North Somerset granite, is composed of gray quartz, red feldspar and green chloritic mica, the latter in large flakes. Both the granite and gneiss of North Somerset are remarkable for their soapy feel.'

'To the east of Cape Bunny, where the Silurian limestone ceases, and south of which the granite commences, is a remarkable valley called Transition valley, from the junction of sandstone and limestone that takes place there. The sandstone is red, and of the same general character as that which rests upon the granitoid rocks of Cape Warrender and at Wolstenholm sound. Owing to the mode of travelling, by sledge on the ice, round the coast, no information was obtained of the geology of the interior of the country, but it appears highly probable that the granite of North Somerset, as well as that of the other localities mentioned, is overlaid by a group of sandstones and conglomerates, on which the Upper Silurian limestones repose directly. A low sandy beach marks the termination of the valley to the northward, and on this beach were found numerous pebbles, washed from the hills of the interior, composed of quartzose sandstone, carnelian and Silurian limestone.'

Cape Granite is the northern boundary of the granite, which retains the same character as far as Howe harbour. It is composed of quartz, red feldspar and dark-green chlorite, and is accompanied with gneiss of the same composition.'

'The granitoid rocks extend across Peel sound into Prince of Wales island in the form of a dark syenite, composed of quartz, greenish-white feldspar passing into yellow, and hornblende.'

ISLANDS OF GROUP IV.

Archæan rocks are found only in the eastern part of this group, on the large islands of Ellesmere and North Devon. They rise from beneath the newer rocks on the south side of Hayes sound a few miles north of Cape Sabine, and then occupy the remainder of the eastern coast of Ellesmere and that of North Devon. This area appears to form a wedge-shaped mass expanding southward, so that on Jones and Lancaster sounds they extend a considerable distance to the westward, until they become capped by limestone, and then gradually sink below the level of the sea.

Both the Laurentian and Huronian divisions of the Archæan are represented in the area. A series of bedded rocks consisting of several thousand feet of sandstones, limestones and other sediments occupies the coast and islands of the east side of Smith sound, from Cape Atholl northward to Foulke fiord. On the west side the northern limit of these rocks is Cape Isabella, from which they occupy the shore of Ellesmere for upwards of twenty miles to the south, the southern limit not having yet been determined on that side.

These bedded rocks are associated with dark coloured traps and diabase, which are present in the form of sills between the bedding; as dikes cutting the bedded rocks and as large intrusive masses. Dr. Sutherland classified these rocks as the equivalents of the Tertiary sandstones of Disko on account of

their lithological resemblance and from the occurrence of traps with both. The southern junction of these bedded rocks with the granites and gneisses forming the Greenland coast to the southward was not seen, but at Foulke fiord and at Cape Isabella the northern contact is quite plain. In both places the bedded series, for some considerable distance from the contact, has been tilted and fractured, while near the contact the sandstones and limestones appear to have been changed into quartzite and crystalline limestones by the injection of great masses of granite. This granite seen at Cape Sabine and Cape Herschel is an ordinary Laurentian granite, and in no way resembles the acidic rocks of Tertiary or Post-Tertiary age, which they should do if the bedded series were of the age assigned to them by Dr. Sutherland. The sandstones, limestones and their associated traps bear a close resemblance to portions of the Huronian series found on Hudson bay and in the interior of Labrador. There is also a similarity between their contacts with the Laurentian granite and some of the contacts found in those more southern localities. No fossils have as yet been found in these rocks, and until such are found it is thought best to remove this series from the Tertiary and place it in the Huronian.

On the past voyage the coast of Ellesmere island was lost sight of about twenty miles south of Cape Isabella, and no land was again seen on the west side of Baffin bay until Philpots island, lying off the east end of North Devon, was reached, where the ship passed sufficiently close to the small outlying islands to show that they were composed of Laurentian gneisses and granites. From thence similar rocks were seen forming the southern shores of North Devon as far as the west side of Croker bay, where they begin to sink slowly to the westward, and are capped by a considerable thickness of flat-bedded limestone, which rests unconformably upon the rounded surface of the older rocks. The Laurentian rocks finally dip below the sea a few miles to the westward of Cuming creek.

The specimens from the Laurentian area, which extends southward from Hayes sound to Cape Isabella, were collected at Capes Sabine and Herschel. The specimens from both localities are very similar, the prevailing rock being a moderately coarse-grained granite, of a dark-red colour, composed largely of red feldspar and bluish quartz, with a small quantity of biotite in diminutive scales. These rocks are only slightly foliated in a few places.

The specimens from the Laurentian measures beneath the Silurian limestones at Cuming creek show a greater variety. A red gneiss, varying in texture from fine to coarse, predominates. It is composed largely of feldspar, with quartz and considerable biotite. It cuts a lighter-coloured, more quartzose gneiss, and also bands of dark mica-diorite-gneiss.

Scottish Whalers in Ponds Inlet.

CHAPTER IX.

SILURIAN.

Islands of Group I.

Flat-lying beds of light-coloured yellow and drab limestone occupy the lowlands of the southern and western parts of Southampton island, and also form outliers in depressions in the crystalline rocks on the north side of the island, notably at Duke of York bay.

A considerable collection of fossils was brought home from the beds forming the southern half of the west coast of the

island. These have been examined by Dr. Ami and Mr. Lambe, whose determinations will be found in Apendix iv. The fossils show that the rocks contain a fauna closely resembling that of the Lake Winnipeg basin, and extend over a period from the Galena-Trenton to the Guelph and Niagara, or from the upper part of the Cambro-Silurian to high up in the Silurian.

Soundings taken on the even bottom of Fisher strait show that the limestones extend without a break to Coats island (to the southward of Southampton), where they occupy all of its surface except the portion at the east end of the island where the Archæan ridge crosses it. A few fossils from Mansfield island show that it also is formed of limestones of these horizons.

At Cape Chidley a collection of fossils from loose pieces of limestone corresponds with fossils from Akpatok island, and the direction of ice movement out of Hudson strait leaves little doubt that the loose limestone of Chidley came from that island. These fossils show a slightly wider range in age than the rocks of Southampton do; they extend from the Lower Galena-Trenton to the Lower Heidelberg.

West Coast of Hudson Bay.

The wide fringe of limestones which is found along the west shores of Hudson bay to the southward of Churchill do not come within the limits of this report. To the northward only Archæan rocks are found along the mainland until the northern half of Melville peninsula is reached, where Parry describes a wide area of sandstone, probably the base of the Cambro-Silurian, as separating the highlands of the interior from the western shores of the northern part of Fox channel. These rocks are continued on the north side of Fury and Hecla strait, where they are found on the west side of Baffin island fronting on Prince Regent inlet.

Islands of Group II.

The only known occurrence of Silurian limestone on the eastern side of Baffin island is at Silliman's Fossil Mount, near the head of Frobisher bay, where the limestone forms a hill 1,000 yards long and 350 feet high, resting almost flat upon the crystalline rocks. Seventy-two species were identified by Schuchert from fossils brought back from this locality; he refers them all to the Galena-Trenton.

Little is known of the limestone about the great lakes, Nettilling and Amadjuak, in the interior of Baffin, beyond the meagre observations of Boas, who briefly refers to the limestone about Nettilling and along the east side of Fox channel. These limestones are probably an eastern extension of the Southampton area, but their exact age will remain unknown until fossils have been collected from them.

On the east side of Prince Regent inlet the rocks composing the high cliffs of Baffin island are the basal sandstone and shale overlaid by limestones, which in places are interbedded with beds of gypsum. These high cliffs of limestone extend eastward along the south shore of Lancaster sound to the mouth of Admiralty inlet, when they give place to the Archæan crystalline rocks, which rise slowly to the eastward from beneath the level of the sea, in a manner similar to that already described, on the north side of Lancaster sound.

Islands of Group III.

The large islands of this group are mainly built of Silurian limestones. North Somerset was the only island of this group visited in the *Neptune,* and all information concerning the others is derived from the observations made on earlier expeditions, and contained in Dawson's summary of the northern geology.

Silurian limestones form the southern third of Banks island, being overlaid in the northern part by beds of Devonian and lower Carboniferous age. Dr. Rae reports the entire southern coast of Victoria island as being composed entirely of Silurian limestone.

'The northern part of King William land, with Matty island to the east of it, are described by Sir John Ross as of limestone. Simpson states the eastern part of the south shore to be also of limestone, and Haughton dealing principally with the results of M'Clintock's voyage writes as follows: "The east side of King William island, though composed of Silurian limestone like the rest of the island, is strewed with blocks of black and red micaceous gneiss, like that of Montreal island, and black metamorphic clay-slate, in which the crystals of mica are just commencing to be developed. It is probable that the granitoid rocks appear at the surface somewhere to the eastward of this locality."

'Numerous excellent though brief notes on the geology of the eastern and southwestern coasts of the Boothian peninsula occur in Sir John Ross' remarkable narrative referred to. From these we learn that the eastern shore is composed of limestone to Port Logan (latitude 71° 21′), where a high range of hills—which is seen at a distance estimated at thirty miles inland at Creswell bay (further north) and runs north-and-south—impinged on the shore, and was found to consist of granitoid and gneissic rocks. Thence southward, from notes given in the body of the narrative, a narrow border of limestone may skirt the shore to about latitude 70° 35′, though the geological appendix does not make any mention of this.'

'The narrow neck of the Boothian peninsula, which was crossed by Ross on several lines, is, from his description, composed of granitic rocks, with some outliers of limestone. One of these, definitely mentioned in the narrative but not in the

geological appendix, is shown on the present map. On the coast of the mainland, west of the isthmus, the limestone formation is found resting on the granites of Lake Wittersted. Northwest from the isthmus the southwest coast of Boothia presents a range of granitoid hills, running northward, but becomes fringed by a low border of limestone near Cape Isabella, and this increases in width to the north, till an extensive flat limestone region is found in the vicinity of the magnetic pole.'

At Bellot strait a junction occurs between the granite and horizontal beds of Silurian limestone.

'The entire western portion of Prince of Wales island is composed of Silurian limestone, which in the extreme west, at Cape Acworth, becomes chalky in character and non-fossiliferous, resembling the peculiar Silurian limestone found on the west side of Boothia Felix.'

The northern and eastern shores of North Somerset are of limestone, usually rising from the water in precipitous cliffs. These were examined at Port Leopold, where the cliffs rise sheer 1,000 feet from the sea. The bedding of the limestone is very distinct, and the face of the cliff has been sculptured by every runlet, so that between the horizontal and vertical markings the cliffs resemble on a gigantic scale the fluted walls of a castle. Fossils were collected from the lower beds of the cliff by M'Clintock, but none were collected on the present voyage.

Islands of Group IV.

The discovery of the Silurian limestone of the southern cliffs of North Devon and Cornwallis was made by Parry, while his collection of fossils was supplemented by those found by the Franklin search expeditions. Our knowledge of the geology of Ellesmere was, previous to the Sverdrup expedition, mainly due to the work of Feilden and De Rance in connection with the British expedition of 1875-76. Mr. P. Schei, the geologist who

accompanied Sverdrup, collected much valuable information concerning the rock formations of Ellesmere. A summary of his observations is published as an appendix to Sverdrup's 'New Land,' and is freely quoted from in the following.

The rocks found on the north side of the Archer plateau, in the eastern part of Ellesmere to the north of Cape Sabine, are very interesting geologically, as they show the only trace of an unbroken sequence of beds from the Huronian up through the Cambrian to the Silurian limestones so widely distributed on the Arctic islands. These rocks are described by Schei as follows: 'At Cape Camperdown, on Bache peninsula, is found granite overlain by an arkose-like conglomerate sandstone, in flat strata, the dip being north-northwest. Its thickness here probably does not exceed 500 feet, though the contour swells to considerably greater magnitude by reason of intrusions of diabase, occasioning an additional thickness of perhaps 300 feet. At its upper part this sandstone merges gradually, by interstratification, into a series of gray, sandy and marl-like schists and limestone conglomerates. From a few inches up to a couple of yards in thickness these conglomerates and schists, continuously interstratified, build up a series 600 to 900 feet in thickness, interrupted by two compact beds of yellowish-gray dolomitic limestone about 150 feet in thickness. These are again overlain by a series similar to the underlying one, excepting that here the limestone conglomerates exceed the schists.'

'In a detached block, in all probability originating from one of the two 150-foot beds, were traces of fossils, of which one, *Leptoplastus* sp., can be identified. In another detached block, whose mother rock is not known, was found *Anomocare* sp. It may be said with certainty after the finding of these fossils that this series contains deposits of the Cambrian age.'

'The second series of conglomerates is overlain by a light grayish-white limestone in a bed some 300 feet in thickness,

observed in the midst of the section of Cape Victoria Head. Indistinct Orthoceras, Lichas and Symphysurus assign this limestone to the Lower Silurian period.'

'Above the othoceras-bearing, light-coloured limestone bed are some less extensive strata of alternating limestone and quartz-sandstone, and finally a 100-foot bed of close brown limestone of which certain layers are fossiliferous, and gave an *Asaphus*, traces of other Trilobites and some Gasteropods.'

'Following the direction of the dip to the north side of Princess Marie bay we find it again, though seemingly somewhat abrupter, in the limestone beds of Norman Lockyer island. A fauna with *Halysites* sp., *Zaphrentis* sp., *Orthisina* sp., *Rhynchonella* sp., *Leperditia* sp., *Illænus* sp., &c., assigns this limestone to Lower Silurian. It is again found with its fauna at the base of Cape Harrison; in this case with a thick superincumbent bed of marly sandstone, quartz-sandstone, and finally extensive limestone conglomerate. This also occurs near the shore in Cape Prescott, indicating by its presence in the strike of the limestone of Norman Lockyer island the disturbance undergone by these tracts.

'The line along which this disturbance took place is refound on the west side of Franklin Pierce bay, where the beds of limestone conglomerate dipping from the heights of Cape Harrison are cut off in the strike by a limestone, dark-gray in colour and broken into a breccia.'

In another place Schei hints that the rocks of the Cape Rawson beds, consisting largely of dark shales and impure limestones, found along the northern parts of the eastern shores of Ellesmere, may be of Triassic age, in sharply folded troughs of the older rocks, and consequently much younger than Cambrian, to which age they were referred by Fielden and De Rance.

Writing of the Silurian beds found on the southern coast of Ellesmere, Schei describes them as answering to the northern series, and their occurrence is as follows:—

'There are at Havnefjord, in Jones sound, above some layers of quartz-sandstone, which entirely cover the gneiss-granite there, a series of limestone conglomerates with marly schists and pure limestones of a thickness of 1,200 to 1,500 feet. These are again overlain by a series of beds at least 2,000 feet thick, of hard, impure limestones, brown or yellowish-gray in colour, and often remarkably heavy.'

'At South cape, which is entirely composed of this brown limestone, are found in the lower parts *Maclurea* sp., and *Halysites* sp., referable to the Middle Silurian, while west of it, at Bjorneborg, the upper parts of the series contain badly preserved remains of Orthocerata, Corals, and *Pentamerus* cfr. *tenuistriatus*. Hereafter the upper part of the limestone seems to be equivalent to the older Upper Silurian (Landovery). This brown limestone occurs from South cape westward to Kobbebugten in Hell Gate, and is broken at Lille Sandor, tectonic disturbance bringing up the underlying conglomerate series, and even the Archæan.'

'On the south side of Rendalen appears the brown limestone of the capes, Series A, with a flat dip to the north-northwest; but on the north side of the valley is a division of dark schist, Series B, lying conformably above the beds of brown limestone. Associated with these schists, particularly in their lower and upper parts, are numerous layers of pure dark limestone, frequently fossiliferous. In Rendalen and in Kobbebugten, where this same division also appears, a quantity of material was collected, of which fifteen species are provisionally determined, among them being *Favosites* sp., *Strophomena* cfr. *euglypha*, *Meristella* in numbers, *Rhynchonella* cfr. *borealis*, *Pentamerus* cfr. *galeatus*, *Spirifer* cfr. *elevatus*. The period of this division in Series B is Wenlock.'

'The upper part of Series B appears, among other places, at the headland north of Tunneldalen, in Hvalrosfjord. Above a

black shale containing *Monograptus* sp. and *Leperditia* cfr. *phaseolus* is a bed of fragmentary limestone with *Favosites, Strophomena* cfr. *pecten, Atrypa reticularis, Pterinea* cfr. *Sowerbyi.* From a locality in Gaasefjord, on the same horizon, were taken *Favosites* cfr. *Hisingeri, Favosites Gothlandicus, Thecia Swinderenana, Spirifer elevatus, Spirifer* cfr. *crispus, Strophomena corrugatella, Dav., Pterinea* sp. According to these, the period of this upper part of Series B should be Ludlow. The thickness of the series is about 1,000 feet.'

'In Hell Gate, as well as in Gaasefjord, these strata are overlaid by Series C; in its lower parts consisting of interstratified light and dark marl schists, which are somewhat sandy, while in its upper part appear pure quartz-sandstone beds and argillaceous sandstone. The collective thickness of these strata is about 1,000 feet in Gaasefjord, while in Hell Gate it is probably somewhat greater. No fossils were found in this series.'

'At the base of the high cliffs at Indra Eide and Borgen appears Series C. In both of these places it is overlain by a dark limestone and black shale, partially fossiliferous. This dark limestone and shale are the lowest layers in a series of strata at least 1,500 feet in thickness, Series D, which appears in the profiles on both sides of Gaasefjord, from Borgen to the foot of Vargtoppen (Wolf Top), and from Indre Eide to Skrabdalen.'

'In Series Da occurs *Atrypa reticularis* in great quantities, but little else. On the other hand, there are preliminary determined in Db about fifty-five species, of which may be mentioned: *Favosites* sp div., *Columnaria* sp., *Cyathophyllum* sp. cfr. *hexagonum, Recaptaculites* sp., *Fenestella* sp., *Homalonotus* sp., *Burmeisteria* sp., *Dechenella* sp., *Proetus* sp., *Orthis striatula, Leptaena* sp., *Strophomena, Streptorhyncus, Atrypa reticularis, aspera; Rhynchonella (Pugnax)* cfr. *reniformis, pugnus, Productus* cfr. *prolongus, Spirifer* of the *Verneuilli*

Murch. type, a peculiar *Pentameride, Terebratula* cfr. *Dielasma, Pterinea* sp., *Modiolopsis* sp. *Lucina* sp. div., *Bellerophon* sp., *Platyceras* sp., *Orthoceras* sp., *Gomphoceras,* gigantic nautilus and ganoid scales.'

'The fauna in Dc is merely a repetition, and in the case of certain species, a further development, of the forms found in Db. It will thus be seen that there is a spring in regard to the fauna between the upper layers in Series B and the lower ones in Series D, which more particularly resemble Lower or Middle Devonian. The concordantly embedded (?) Series C might, therefore, be thought to represent uppermost Silurian as well as lowest Devonian.'

'Divisions Dd and Df are poor in fossils, and are partly shale divisions. In the impure limestone of Dg occur again numerous fossils, among which are *Atrypa reticularis, Rhynchonella* cfr. *cuboides, Spirifer* cfr. *undifera, Productus* sp., *Terebratula* cfr. *Dielasma, Pterinea* sp., *Avicula* sp., *Modiolopsis* sp., *Pleurotomaria* sp., *Proetus* sp. Traces of placoderm fish are also met with. Above these strata are beds of purer limestone Dh, and above these again some less pure, Di. The uppermost strata of Di alternate with strata of light-gray quartz-sandstone terminating in a clay-sandstone, which in places is richly fossiliferous, though the fossils are in a bad state of preservation. Among these are lamellibranchiata, *Dechenella* sp., remains of *Holoptychius,* &c.'

'This argillaceous sandstone is simultaneously the last link in Series D and the first in Series E. This is a huge collection of quartz-sandstone strata building up the mountains on both sides of the inner part of Gaasefjord. The lowest part, which is 900 to 1,200 feet in thickness, consists almost exclusively of quartz-sandstone. On the north side of Skrabdalen, in the sandstone profile, occur conglomerate strata, half an inch to an inch in thickness. In these were found considerable remains

of *Coccosteus* sp., *Holoptychius* sp., and *Modolia angusta*. In the same strata with these were also seen indeterminable plant-fossils. Slightly higher up in the profile, however, in a black shale which occurred in two lentiform masses, eighteen inches and six feet in thickness, were found numerous plant-fossils.'

'Professor Nathorst, of Stockholm, who has kindly undertaken the examination of these, says that among others are *Archæopteris fissilis* Schmalh. and *Arch. archetypus* Schmalh., both characteristic of Upper Devonian. In examining the material collected, Professor Nathorst also found with the plant remains some remains of fishes.'

From the above it will be seen that on the southern side of Ellesmere there is a complete succession of strata, bearing fossils from Middle Silurian age up to the Upper Devonian. These strata have an aggregate thickness of 8,000 feet, and form the thickest and most carefully measured section of the Silurian and Devonian beds of the Arctics.

On the southern and southwestern parts of North Devon the Silurian strata are much thinner than those described by Schei. At Cuming creek the Archæan gneisses were found overlain unconformably by red and purple arenaceous shales and thin bedded sandstones having an aggregate thickness of fifty to one hundred feet. These in turn were succeeded by beds of impure limestone of light-gray or creamy colour. The beds are usually under two feet in thickness, and separated by thinner beds containing a considerable amount of clay. These light-coloured limestones have a thickness of over 1,000 feet in the cliffs on both sides of the creek. The sides of the cliffs are covered with broken limestone, so that it was impossible to measure a section up them, but in two or three places a darker coloured limestone conglomerate was found, made up of small pebbles cemented by a dark shaly matrix. Fossils are only found in the beds immediately overlying the dark shales and sandstones of the base.

Limestone Cliffs of North Devon Island.

BOSTON PUBLIC LIBRARY

These show that the lower limestone is of Silurian age, about the horizon of the Niagara.

Similar conditions prevail in the cliffs at Beechey island, where a large collection of fossils was obtained from the lower limestone beds, while others, picked up loose, but evidently fallen from the cliffs above showed that the upper beds passed close to if not into the Devonian, as stated in Appendix IV.

Similar Silurian limestones constitute the island of Cornwallis, to the westward of North Devon, while in the remaining Parry islands farther west the Silurian strata are lost beneath the Devonian and Carboniferous rocks of those islands.

DEVONIAN.

The work of the older geologists, which was summarized by Haughton and later by Dawson, took no account of the Devonian in their divisions of the Palæozoic rocks of the islands north of Lancaster sound. All the lower limestones were classed as Silurian, while the overlying sandstones were placed in the Carboniferous. Fossils of Devonian age were collected, by the expedition of 1876, from the northern part of Ellesmere, but their occurrence and relations were only finally settled by Schei as given above. From his observations it is plain that the upper part of the limestones and the lower 1,000 feet of the overlying sandstones are of Devonian age. The early explorers were not trained geologists, and it could hardly be expected that they would discover the thin bands containing fossils in these great thicknesses of barren beds. Owing to this supposed lack of fossils the rocks were separated into Silurian and Carboniferous almost wholly on lithological differences, the limestones being classed as Silurian and the sandstones as Carboniferous.

There is no doubt that Devonian rocks are included in the Carboniferous of the western Parry islands, but as they occur only in the cliffs underlying the Carboniferous beds that cover

the surface of the islands, it would be impossible to map them on the scale used in illustrating this report, and in consequence the old colouring is followed here.

CARBONIFEROUS.

The southern boundary of the Carboniferous sandstones with their included coal seams crosses the southern part of Banks island in a north-northeast direction, and they consequently cover the northern two-thirds of that island, while the extreme northwest portion of Victoria island is also occupied by these rocks. The western Parry islands on the north side of Melville sound are almost wholly formed of these rocks, whose southern boundary strikes northeast across the northern half of Cornwallis island. They are found again in Grinnell peninsula, the northwest portion of North Devon, and again on the western side of Ellesmere, in the vicinity of Store Bjornekap, being probably largely developed in the northeast part of that great island.

These rocks are described as follows by Professor Haughton: 'The Upper Silurian limestones, already described, are succeeded by a most remarkable series of close-grained, white sandstone, containing numerous beds of highly bituminous coal and but few marine fossils. In fact the only fossil shell found in these beds, as far as I know, in any part of the Arctic Archipelago is a species of ribbed *Atrypa,* which I believe to be identical with the *Atrypa fallax* of the Carboniferous slate of Ireland. These sandstone beds are succeeded by a series of blue limestone beds containing an abundance of marine shells, commonly found in all parts of the world where the Carboniferous deposits are at all developed. The line of junction of these deposits with the Silurian on which they rest is N. E. to E. N. E. (true). Like the former, they occur in low flat beds, sometimes rising into cliffs, but never reaching the elevation attained by the Silurian rocks in Lancaster sound.'

Coal, sandstone, clay-ironstone and brown hematite, were found along a line stretching E.N.E. from Baring island, through the south of Melville island, Byam-Martin island and the whole of Bathurst island. Carboniferous limestones, with characteristic fossils, were found along the north coast of Bathurst island, and at Hillock point on Melville island.

From the comparison of different coal exposures noted by M'Clintock, M'Clure, Austin and Parry in the Parry islands, Professor Haughton has laid down the approximate outcrops of some of the coal beds. These he finds to agree remarkably well with the trend of the boundary of the formation drawn from totally different data. Lists of fossils and rocks from the following places, with notes, are given: 'Hillock point, Melville island (latitude 76° N., longitude 111° 45′ W.). Bathurst island, north coast, Cape Lady Franklin (latitude 76° 40′ N., longitude 98° 45′ W.). Princess-Royal island, Prince of Wales strait, Baring island (latitude 72° 45′ N., longitude 117° 30′ W.). In connection with this place it is noted that the Carboniferous sandstones underlie the limestones, and that it is probable that the coal beds of Melville island are very low down in the series, and do not correspond in geological position with the coal beds of Europe. Cape Hamilton, Baring island (latitude 74° 15′ N., longitude, 117° 30′ W.). Cape Dundas, Melville island (latitude 74° 30′ N., longitude 111° 45′). Cape Sir James Ross, Melville island (latitude 74° 45′ N., longitude 114° 30′). Cape Providence, Melville island (latitude 74° 20′ N., longitude 120° 30′ W.). Winter Harbour, Melville island (latitude 75° 35′ N., longitude 110° 45′ W.). Bridgeport inlet, Melville island (latitude 75° N., longitude 109° W.). Skene bay, Melville island (latitude 75° N., longitude 108° W.). Hooper island, Lyddon gulf, Melville island (latitude 75° 10′, longitude 112° W.). Byam-Martin island (latitude 75° 10′ N., longitude 104° 15′ W.). Graham-Moore bay,

Bathurst island (latitude 75° 30′ N., longitude 102° W.). Bathurst island, Bedford bay (latitude 75° N., longitude 95° 50′ W.). (Vesicular scoriaceous trap rocks were found here by M'Clintock, though no such rocks are mentioned elsewhere in connection with the Carboniferous.) Cornwallis island, McDougall bay. Silurian and Carboniferous fossils were found together at the last mentioned place.'———

Professor Haughton also notes that 'the sandstone of Byam-Martin island is of two kinds—one red, finely stratified, passing into purple slate, and very like the sandstone of Cape Bunny, North Somerset, and some varieties of the red sandstone and slate found between Wolstenholm sound and Whale sound, West Greenland, latitude 77° N. The other sandstone of Byam-Martin island is a fine, pale-greenish, or rather grayish-yellow, and not distinguishable in hand specimens from the sandstone of Cape Hamilton, Baring island.' Parry also describes Byam-Martin island as essentially composed of sandstone, with some granitic and feldspathic rocks, these last being probably erratics.

Respecting the coal seams which have been discovered in the Arctic Archipelago, Professor Haughton further remarks: 'If the different points where coal was found be laid down on a map, we have, in order, proceeding from the southwest, Cape Hamilton, Baring island; Cape Dundas, Melville island, south; Bridgeport inlet and Skene bay, Melville island; Schomberg point, Graham-Moore bay, Bathurst island; a line joining all these points is the outcrop of the coal-beds of the south of Melville island, and runs E.N.E. At all the localities above mentioned, and indeed in every place where coal is found, it was accompanied by the grayish-yellow and yellow sandstone, already described, and by nodules of clay-ironstone, passing into brown hematite, sometimes nodular and sometimes pisolitic in structure.'

Dr. Armstrong, of the *Investigator,* referring to the northern part of Banks island, states that outliers of Carboniferous limestone are found at Cape Crozier and near Mercy bay, along with the sandstones and shales with coaly streaks.

It is doubtful if the Carboniferous rocks occur on the northwest part of North Devon, though placed there by De Rance and Dawson. Schei found only Silurian and Devonian on the northern part of that island explored by him, and the Carboniferous rocks do not show on the west coast of Ellesmere until Store Bjornekap is reached. If a line were carried from the outcrops of these rocks on Bathurst island northward to Store Bjornekap it would cross the western part of Grinnell (island) peninsula, but there is no reason to suppose that the outcrop would follow such a line.

The Carboniferous rocks of western Ellesmere appear to be isolated areas resting upon the underlying Devonian, and in turn covered by Mesozoic rocks. Schei describes the area at Store Bjornekap as consisting in its lowest part of beds of brownish-gray, hard, fossiliferous limestone; higher up, of a white pure limestone, flinty limestone and pure flint strata, richly fossiliferous, among the fossils being *Lithostrotion* sp., *Fenestella* sp., *Streptorhynchus crenistria, Rhynchonella (Pugnax)* sp., *Spirifer* cfr. *ovalis, cuspidatus, mosquensis, Productus* cfr. *semireticulatus, costatus, punctatus, cora,* &c.

The extreme northeast part of Axel Heiberg island is marked as Carboniferous by Schei, but there are no notes concerning this locality in his geolocigal summary.

The Carboniferous sandstones have not been found in the northeast part of Ellesmere island, but limestones of that age were found in several localities to the west of Dana bay, and there is every likelihood that rocks of this age extend across the northern part of the island to join those of the western shore and the northern part of Axel Heiberg island.

MESOZOIC.

The discovery of the Sverdrup group of islands has greatly extended our knowledge of the Mesozoic rocks of the Arctic basin. The Franklin search parties discovered rocks of this age on the northern shores of the Parry islands; at Point Wilkie, in Prince Patrick island; Rendezvous Hill, near the northwestern extreme of Bathurst island and at Exmouth island and places in the vicinity, near the northwest part of North Devon. The explorations from the *Fram* now show that these are but the southern edge of a wide basin of these rocks which form the islands of King Oscar, Ellef and Amund Ringes, while they constitute the lowlands of Axel Heiberg and the western shores of Ellesmere along both sides of Eureka sound. There they consist largely of sandstones with shales, schists and limestones.

As before stated, Schei hints that their eastern extension to the shores of Kennedy channel may be marked by the tilted and folded strata, classed by De Rance as the Cape Rawson Series, of supposed Cambrian age.

TERTIARY.

Deposits containing fossil wood were discovered by M'Clintock, M'Clure and Armstrong in the southwestern part of Prince Patrick island and on the northwest side of Banks island.

'At Ballast beach, on Banks land, large quantities of fossil and sub-fossil wood occur, which Prof. Heer refers to the Miocene in his Flora Fossilis Arctica, in which the following species are described by Cramer: *Pinus MacClurii, Pinus Armstrongi, Cupressinoxylon pulchrum, Cupressinoxylon polyommatum, Cupressinoxylon dubium, Betula M'Clintockii.*

In many places along the western side of Ellesmere, in the depressions between the mountains, thick deposits of sand with embedded strata of lignite were found. Similar deposits were

found in the lowlands east of Blaamanden, and at the head of Stenkulfjord in Baumann fjord. In addition to the lignite, masses of slaty clay were found in the latter place, in which were well preserved remains of *Sequoia Langsdorfii, Taxodium distichum* var. *miocenum* and some others, well known witnesses to a southern vegetation in these regions in a geologically late period, i.e., the Miocene.'

The knowledge of the Tertiary deposits of the east side of Ellesmere is summarized as follows by Dawson: 'Small outlying areas of Tertiary (Miocene of Heer) are noted as occurring at Water-course bay, at the entrance of Lady Franklin sound, and in two places on the north shore of the sound. Coal is found in these beds in association with black shales and sandstones, and from collections made by Capt. Fielden and Dr. Moss, Prof. Heer describes thirty species of plants closely allied to the Spitzbergen Tertiary flora, and indicating rather colder conditions than are expressed by the character of the Disko island Tertiary plants. The coal appears to be an excellent fuel, containing only 2·01 per cent of water.'

'Capt. Greely's expedition (1881 to 1884) though so important in its results from a geographical point of view, has added comparatively little to our geographical knowledge of Grinnell land and the northern coast of Greenland, a fact due to the absence of a geologist and the enforced abandonment of the specimens collected. From a careful perusal of Capt. Greely's narrative ('Three Years of Arctic Service, 1886'), and from information obligingly supplied by him and by Lieut. Brainard, in answer to inquiries made by correspondence, some facts of importance are, however, brought out. The Tertiary coal-bearing formation is evidently much more widely spread in the part of Grinnell land, in the vicinity of Lady Franklin sound, than the previously quoted map of Messrs. Fielden and De Rance would indicate, though it may probably be regarded as forming

detached outliers (which I do not venture to outline) on the Cape Rawson beds, shown by these authors to characterize the region generally. Bituminous coal was found at Lincoln bay, half a degree north of the mouth of Lady Franklin sound, on the east Grinnell land coast, in different parts of the Bellows valley (which runs inland to the north of the same sound) to the head, and in the neighbourhood of Lake Hazen, to the westward, by Capt. Greely. Lieut. Brainard also describes in an appendix a fossil forest discovered by him in Archer fiord, a few miles west of Cape Baird, which, with the associated rocks, is without doubt referable to the Tertiary. Toward the head of Chandler fiord (running west of Lady Franklin sound) Greely mentions high cliffs of 'schistose slate,' and in Ruggles river, the outlet of Lake Hazen, large slabs of 'slate,' which had been used by the Eskimos in building their huts. Brainard speaks of the cliffs of Beatrix bay as dark, those of Ella bay as very light, in colour. These bays constitute the termination of Archer fiord. He remembers the cliffs on Musk-ox valley to have been again of dark colours. Respecting Greely fiord, on the west coast of Grinnell land, he quotes from his diary: 'On the north shore of this fiord the line of cliffs presents a feature of marked peculiarity; horizontal lines or strata of different colours run uniformly for miles along their face.' He adds: 'The predominating colours in these lines and of the cliffs was a pale-yellow. On the south side, where we were camped, the cliffs were of about the same colour as those spoken of above, but the strata were not noticed. They were from 1,500 to 8,000 feet above the sea-level, and presented a castellated appearance. Fossils in great numbers were found here.'

To the west of the narrows of Ponds inlet, the high hills of crystalline rock retreat from the southern shore of the inlet, leaving a wide plain of stratified sand, gravel and clay, which extends far to the west and southwest, and is penetrated by a

number of deep bays on that side of the inlet. This plain is indented by all the water-courses traversing it, and in the beds of the principal streams broken lignite is found, evidently fallen from beds of that mineral in the banks above. The presence of lignite in these stratified deposits points to their being Tertiary in age, and corresponding with the northern areas of this formation already described as lying undisturbed in the wide valleys of the older rocks. This area in the northern part of Baffin island is, according to the natives, quite extensive, and probably extends in a southwest direction to the lowlands of the northern and western sides of Fox channel.

Capt. Adams, of the whaler *Diana,* said that lignite was to be found in similar deposits near Cape Hay, on the east side of Bylot island, and also at Durban island on the eastern coast of Baffin island. There is little doubt that other areas of these Tertiary deposits occur on the Arctic islands, but owing to no lignite or fossils having been found in them they have not been separated from the drift and newer Post Tertiary deposits of sand, gravel and clay of these coasts.

If Tertiary deposits were laid down on the lands of the western side of Hudson bay, there is little chance of more than small protected areas having escaped the intense glaciation to which the western shores of the bay were subjected. Any such remaining areas are now probably hidden beneath the mantle of drift so universal on the low lying portions of this region.

POST TERTIARY.

Little or no attention was given by the earlier explorers to the markings of ice-striae and other glacial phenomena, and the only records of the movement of the glacial ice noted by them was the distribution of erratic boulders. These observations have been summarized by Dawson as follows: ‘ Along the Arctic coast, and among the islands of the archipelago, there is a con-

siderable volume of evidence to show that the main direction of movement of erratics was northward. Thus, boulders of granite supposed by Prof. Haughton to be derived from North Somerset are found 100 miles to the northeastward, and pebbles of granite, identical with that of Granite point, also in North Somerset, occur 135 miles to the northwest. The east side of King-William land is also said to be strewn with boulders like the gneiss of Montreal island, to the southward. Prof. Haughton shows the direction and distance of travel of some of these fragments by arrows on his geological map of the Arctic archipelago, and reverts to the same subject on pages 393-394, pointing out the general northward movement of ice indicated, and referring the carriage of the boulders to floating ice of the glacial period.'

'Near Princess Royal island, in Prince of Wales strait, and also on the coast of Prince of Wales island, the copper said to be picked up in large masses by the Eskimos may be supposed to be derived from the Cambrian rocks of the Coppermine river region to the south, as it is not probable that it occurs in place anywhere in the region of horizontal limestone where it is found.'

'Dr. Armstrong, previously quoted, notes the occurrence of granitic and other crystalline rocks, not only on the south shore of Baring land, but also on the hills inland. These, from what is known of the region, can scarcely be supposed to have come from elsewhere than the continental land to the southward.'

'In an account of the scientific results of the *Polaris* expedition, it is stated of the west coast of Smith sound, north of the Humboldt glacier, that "wherever the locality was favourable the land is covered by drift, sometimes containing very characteristic lithological specimens, the identification of which with rocks of South Greenland was a very easily accomplished task. For instance, garnets of unusual large size were found in lati-

tude 81° 30′, having marked mineralogical characters by which the identity of some garnets from Tiskernaces was established. Drawing a conclusion from such observations, it became evident that the main line of the drift, indicating the direction of its motion, runs from south to north." '

Dr. Bell in his report on the geology of Hudson bay and Hudson strait, 1885, draws attention to the flow of the ice from the land on both sides of the strait into that body of water, while the striæ on the islands in the strait show that a great stream of ice passed eastward through the strait from Hudson bay into the north Atlantic. These observations have since been confirmed by observations of the striæ on other islands of the strait.

Tyrrell's observations on the glacial phenomena of the barren-land region west of Hudson bay show that the country was intensely glaciated; that the centre of glaciation was on a nearly level plain now elevated some 400 or 500 feet above sea-level, there being no evidence to show that it was much more elevated during the period of glaciation. The centre of ice distribution was situated close to the western shores of Hudson bay, and the moisture sufficient to allow of such an accumulation of ice was probably derived from an open Arctic sea. The glacier moved south and southwest from this centre up a gradual grade to Manitoba, where morainic accumulations are found on the summits of the Duck mountains at elevations from 1,800 to 2,400 feet above present sea-level. Striae evidently formed by moving ice from this centre have been found by Dr. Barlow and the writer on the branches of the Moose river to the south of James bay, where the movement was from the northwest.

There is little doubt that the ice also moved northward from the centre of glaciation, and that the evidence quoted above of the erratics found in the western Arctic islands is proof of this.

From a study of the different sets of glacial striæ, Tyrrell concluded that the centre of glaciation was, in the early part of the glacial period, somewhere to the north and west of the head of Chesterfield inlet; that later, when the ice increased in thickness, the centre of dispersion moved to a position southwest of Baker lake; while as the glacier diminished the centre moved nearer the seashore, and the final stage was probably represented by the ice-cap breaking up into a number of distinct glaciers, each with local movement of its own.

These conclusions of Tyrrell as to the southern movement of the centre of glaciation are borne out by the writer's observations of the striæ along the shores of Roes Welcome, where as many as six sets of striæ were found at Whale point, the usual number being three. The oldest set, found only at Whale point, showed that the ice movement was from the northwest. The next in age were from N. 50° E., or almost at right angles to the oldest; following in order of age come striæ from N. 25° E., N., N. 30° W., and N.W. The last three sets are found in a number of places between Winchester inlet and Whale point; the others only at Whale point. The direction of the above sets of striæ apparently shows that the earliest accumulation of ice in the region north of the western side of Hudson bay was somewhere to the northwest; this was followed by an abrupt change in the ice-movement, which was next from almost northeast, after which the centre of movement of the ice-cap gradually shifted, by way of north, to northwest. It would also appear that the centres of dispersion were much greater in area than the limits placed upon them by Tyrrell.

This southern movement of the centre of dispersion of the ice is diametrically opposite to what occurred in the case of the ice-cap of Labrador, where the striæ along the east side of Hudson bay show that the centre of ice-movement changed from a position near the central area of the peninsula, a short distance

north of the southern watershed, to one some three hundred miles north, in the vicinity of the headwaters of the Koaksoak river.

The glaciation of Labrador seems to have been later than that of the western side of Hudson bay, as the striæ from the western glacier are almost obliterated by those from the east and northeast along the rivers south of James bay.

There is a marked difference in the evidence of the intensity of glacial action between the southern regions and the eastern and northern portions of the great area embraced in this report. On the shores and islands of Hudson bay and Hudson strait the crystalline rocks have been denuded of every trace of rotted surface material; they have been smoothed, polished and intensely striated, and their present condition is such that little or no change has taken place since the disappearance of the ice, which once covered them deeply, the striæ being so fresh as to appear of the formation of yesterday. When the eastern mouth of Hudson strait is left, a change is soon seen in following the eastern side of Baffin island northward. The hills are less rounded, and talus lies on the slopes of the cliffs; about Cumberland gulf and Cyrus Field bay there is evidence of a universal ice-cap having been present, but the rounding, polishing and striation of the rocks are markedly less than to the south and westward. In these places it is exceedingly difficult to find striæ upon the rock surfaces, and these when found show that the movement was local and from the highlands towards the open sea. In the northern part of Baffin island the hills become more serrated in outline, and many of the higher points appear to have never been subjected to glaciation, the glaciers having only filled the valleys; if an ice-cap existed the ice-movement to the coast was determined by the course of the local valleys, and there is no evidence of a movement not depending upon local conditions as is the case in the region about Hudson

bay. At Erik harbour, on the south side of the mouth of Ponds inlet, there is evidence that the glacier which now terminates at the head of the harbour once extended five miles farther seaward, and filled the valley to a height of 400 feet above the present level of the sea. Above that height the rocky walls of the harbour are not glaciated, and are covered by slopes of disintegrated rock. Passing north of Lancaster sound to the south of North Devon, there is little evidence to show that the glaciation was ever much more severe than at present. At Cuming creek, a narrow fiord cut some twelve miles into the limestone cliffs, there is evidence that a glacier once covered its bottom, and rose some two or three hundred feet above the present level of the sea; but it was purely local, and the limestone cliffs everywhere show that they have been long subjected to subaerial denudation, and that the broken rock covering their sides has never been displaced by ice.

Very little time was given to the study of glaciation at Cape Sabine, and the only evidence to show that it was more intense formerly was a low moraine in rear of Peary's house at Payer harbour. Schei, who devoted considerable attention to the glaciation of Ellesmere, is of the opinion that the ice covering never greatly exceeded its present limits, if it did so at all.

MARINE TERRACES.

Marine terraces are found along the coasts of the northern mainland and islands wherever the conditions are suitable. Fronting the highlands about Wager inlet and Repulse bay, on the western side of Hudson bay, terraces are found cut into the drift deposits up to elevations varying from 500 to 700 feet. The highest terrace seen by Dr. Bell on the north side of Hudson strait had an elevation of 528 feet above the present sea-level. At Cape Wolstenholme, on the south side of the western entrance to Hudson strait the terraces rise to 800 feet above the

sea. At Douglas harbour on the same side and near the middle of the strait the highest terraces noted were little over 400 feet. Along the eastern shores of Baffin island terraces were constantly seen, which were estimated to rise from 500 to 700 feet above the sea. Schei found terraces with Post-Pliocene fossils at an elevation of 650 feet along the shores of Ellesmere.

The foregoing evidence shows that at the close of the period of maximum glaciation an uplift occurred to the land throughout the northeastern Arctic region. This uplift is marked by the terraces existing on all the shores, but they fail to agree with the theory that the uplift was greatest where the accumulation of ice was greatest. There appears to be no great difference in the height of the terraces in Ellesmere, where the glaciation, never excessive, remains in nearly the same state as when it was at its maximum thickness and of those about the shores of Hudson bay, where an enormous thickness of ice once covered the land and has now entirely disappeared.

The uplift, which took place in comparatively recent times, geologically speaking, does not appear to be going on at present, as all the historical evidence relating to the Hudson bay region points to a remarkable stability in the coastal regions from the time of the first records dating back to the voyage of Munck in 1619.

The present glacial conditions of the Arctic islands has been noted in another part of this report, and it need only be here stated that the lands fronting upon Hudson bay and Hudson strait are now free from glaciers, the nearest approach being the occurrence of detached snow banks in protected positions, which remain throughout the year. The most southern glacier is the Grinnell glacier situated on the north side of the high land separating Hudson strait from Frobisher bay, and plainly seen crowning the summit of the north shore of Hudson strait for a distance of more than fifty miles. This glacier is not very

active, and is said to discharge only a few small icebergs into one of the fiords on the south side of Frobisher bay. Passing northward along the eastern coast of Baffin island, the snow patches upon the hills become larger and more numerous, but it is not until Cumberland gulf is passed that real glaciers appear in the valleys leading down to the sea. These are not very active, and seldom shed icebergs except on the northern part of the island. Active glaciers are found along the southern side of North Devon westward to the neighbourhood of Cuming creek, west of which the ice-cap retreats, and the shores and cliffs are free of ice. The valleys of the eastern and southeastern coasts of Ellesmere are filled with active glaciers that discharge many large icebergs. In the southwestern part the glaciers are not very active, and usually terminate at a considerable distance from the sea.

ECONOMIC MINERALS.

With the exception of the area of iron-bearing rocks on the islands along the east coast of Hudson bay, no systematic prospecting has been done for minerals in the wide region covered by this report. Active mining at the present is confined to a mine of mica, situated at Lake harbour, on the north side of Hudson strait, a few miles east of Big island. Earlier mining consisted of the extraction of small quantities of coal from the outcrops of that mineral on Melville and Ellesmere islands by expeditions wintering there. Our knowledge of the minerals extends only to the chance observations of the earlier explorers, and to the hurried examinations made by members of the staff of the Geological Survey in the southern parts of the region under consideration.

The occurrence of Laurentian and Huronian rocks over large portions of the area, both on the islands and mainland, leads to the belief that important mineral deposits exist there in the

same manner as in more southern regions of similar rocks; in fact, specimens of the more important minerals are reported from the north.

Gold.—The occurrence of gold is reported only from the head of Wager inlet, where specimens of free gold were found in the dark rocks of that locality by Dr. Rae.

The presence of large areas of undisturbed Tertiary sands and clays in the northern part of Baffin island and elsewhere are favourable to the accumulation of placer gold deposits, if the precious metal occurs in the underlying Laurentian and Huronian rocks. It would be well to test the beds of the streams flowing through these deposits when they are again visited.

Silver.—A small quantity of silver is found in the galena, which occurs in pockets in the limestone along the Whale river coast on the east side of Hudson bay. The amount of galena is small, and so widely scattered that it would probably be unprofitable to mine even in favourable circumstances.

Copper.—Tyrrell discovered large masses of Huronian rocks along the western shores of Hudson bay, to the south of Marble island. In these were many bands and masses of dark schists, all carrying quantities of iron and copper sulphides. Of these deposits he reports as follows: 'At a point northeast of Rabbit island the character of the shore changes, and dark-green Huronian schists crop out from beneath the boulders.'

'North of Rabbit island is a high point, on which the Eskimos are accustomed to camp while waiting for the traders from Churchill. The point is composed of green calcareous, chloritic schist, striking S. 55° W., and dipping N. 35° W. at an angle of 60°. The schist is cut by a dike seventy-five feet wide, of massive green, highly altered diabase, containing a large amount of mispickel. This diabase also outcrops along the shore, where it incloses many bands of schists.'

'The rock at the point south of Corbett inlet is a massive green, fine or medium-grained diabase, which is now almost entirely altered into a mass of chlorite, epidote, zoisite and calcite.——— This diabase is cut by many small veins of quartz and calcite, which contain large quantities of pyrite, arsenopyrite and chalcopyrite.'

'From Term point westward the shore is rocky, and the steep rocky cliffs descend into rather deep water. The rock is a dark-green diabase almost entirely altered to sausserite, and is cut by many veins of quartz and calcite, holding copper-pyrites.'

'On the northern shore of Mistake bay, nine miles west of Term point, is a long point of similar diabase. Seven miles further southwest, about the middle of the west shore of Mistake bay, is a high point of similar dark-green diabase, containing in many places a large amount of copper-pyrites, and cut by small veins of quartz studded with iron pyrites.'

'Two miles south of Sir Biddy island is a prominent rocky point, with a high rocky island lying a short distance off it. From this prominent point the shore turns westward, and is bold and rocky, being composed of dark-green fine-grained diabase, studded with copper-pyrites.'

The above extracts from Tyrrell's report show that on his hurried journey southward from Chesterfield inlet he found Huronian rocks occupying the shores of the bay for a distance of nearly a hundred miles. At haphazard landings along this shore traces of copper deposits were found in a number of places, and these would point to important discoveries as likely to follow systematic search on this area.

A considerable amount of magnetic pyrites was found in the squeezed diabase rocks along the east coast of Hudson bay, but careful analyses failed to show any contained gold, nickel or copper in a number of specimens from various localities on that

coast, and it is highly probable that no important deposits will be found in the basic rocks of that side of the bay.

Small quantities of copper-pyrites were observed in the diabase schists of the south side of Hudson strait, but never in sufficient amounts to constitute mines of that mineral.

I was informed by Captain Adams, of the whaler *Diana,* that he had picked up specimens of copper ore lying loose on the surface a few miles in rear of Clyde river on the east coast of Baffin island.

Among the specimens brought home by Hall from Frobisher and Cyrus Field bays, in the southeast part of Baffin island, were bornite and pyrite, showing that copper ores also occur in that portion of the island.

Iron.—Mention has been made of the iron ores on the west shores of Ungava bay, on the north side of Payne river. The rocks in which these ores are found have been altered by the intrusion of granites. They now consist of quartzites, mica-hornblende schist and crystalline limestone, and are the metamorphic representatives of the unaltered iron-bearing rocks of the interior of Labrador peninsula and the east coast of Hudson bay. In localities where the rocks are unaltered the iron ores occur either as carbonates in a cherty rock, or as a mixture of magnetite and hematite intimately associated with chert and jasper. At Payne river the iron-bearing beds have a thickness of 420 feet. The upper 70 feet is a light-yellow, fine granular quartzite containing patches of ankerite and lime. Towards the top the rock shades to a dark bluish-gray, from the presence of large quantities of magnetite in small flattened grains, together with small scales of specular iron. These are usually mixed with quartz with evidence of foliation, and at other places are in large masses of nearly pure ore. Underlying these beds is 350 feet of dark-bluish slaty quartzite holding considerable magnetite and hematite, and shading upwards into a

barren quartzite. Most of the ore of this locality would probably require separation and concentration from the admixed quartz before being of a grade sufficiently high for smelting. The position of the deposits on the west side of Ungava bay, where the tide rises and falls forty feet or more, is not very promising for shipping.

More attention has been given to the iron deposits of the east side of Hudson bay than to any other of the mineral deposits of the north. In 1877, Dr. Bell explored the east shore of Hudson bay as far north as Cape Dufferin, and in his report on this exploration called attention to the deposits of iron ore found in a bedded series of rocks, chiefly sandstones, cherts and dolomites. These rocks he found forming the islands along that coast from Cape Jones, at the mouth of James bay, to Cape Dufferin, some 300 miles farther north. A strip of the same rocks occupies the mainland from the vicinity of Great Whale river to beyond the head of Richmond gulf, a distance of 120 miles.

The iron ores of value were found to be confined to the Nastapoka chain of islands, which extend northward from Little Whale river for a distance of 100 miles.

A further examination of these iron-bearing rocks was made by the writer during the summers of 1898 and 1899, and more closely during the summers of 1901 and 1902 when engaged in this work for a private company.

These iron-bearing rocks of the east side of Hudson bay have a close resemblance to those of Lake Superior, so famous for the amount and quality of their associated ores of iron. They consist of bedded sandstones, cherts, shales, graywackes and dolomites, associated with great outflows and sills of trap. The following general section of the rocks of the Nastapoka islands will give a good idea of the rocks there, while on the mainland other strata, free from or poor in iron, are found.

Descending order:—

	feet.
1. Rusty weathering, dark gray, siliceous rock containing ankerite (carbonate of iron and magnesia) and magnetite	20 to 100
2. Dark gray siliceous rock, containing magnetite with small quantities of ankerite	50 to 250
3. Red jaspilite rich in hematite ore	10 to 100
4. Red jaspilite poor in hematite ore	5 to 20
5. Purple or greenish weathering, dark-green graywacke shales	10 to 70
6. Red jaspilite poor in hematite ore	0 to 5
7. Light greenish-gray sandstone and shale	10 to 300
8. Fine grained dolomite	0 to 50

The iron ores have a greater thickness and are richer on the islands in the middle of the chain than elsewhere.

The rusty weathering, dark-gray siliceous rocks of division I. are found on all the islands from Flint to McTavish, being wanting only on Cotter island. The typical rock is a dark-gray chert made up of finely divided silica showing under the microscope small grains of quartz filled in by later accessions of that material in a finely divided state. It contains minute crystals of magnetite scattered through the mass, and also patches of crystalline carbonates. At the southern end of the chain it is cherty and sometimes light-green in colour. These rocks are usually in thin beds, the parting between the beds filled with brownish ankerite, which also occurs in flat lenticular masses inclosed in the cherts; many of these masses are several inches in thickness and several square feet in area, so that the rock usually contains from twenty to fifty per cent of ankerite. These ores are too much broken and too intimately mixed with the cherts for profitable mining. The rusty character of the rock is due to surface decomposition of ankerite to limonite. The beds increase in thickness as the islands are followed northward, and reach their maximum

development on Davieau island and northward to McTavish island, where they have a thickness of fifty feet. These measures can be traced southward from the Nastapoka chain in the outer islands lying along the coast for upward of 150 miles, being last seen on Long island just north of Cape Jones, where they are overlaid by a considerable thickness of trap.

The second division of the section is an arbitrary one, and was made to embrace all the beds containing important deposits of magnetite. The upper beds of the division grade into those of division I, while the lower pass gradually into division III.

The typical rock of these measures is a dark-gray, fine-grained variety of quartzite chert, containing considerable magnetite scattered through it in minute crystals; it also contains small quantities of carbonates of iron, magnesia and lime. The beds are usually thin (from one to twelve inches) and the partings between them are filled with a mixture of silica and magnetite with small quantities of ankerite. These partings vary in thickness, but are generally thin between the upper beds of the division, and quite thick (six inches to forty-eight inches) towards the bottom, where they form important ores of iron; as the beds of chert are often quite thin between two or more thick partings of ore, they might easily be neglected in mining. The mixture of silica and magnetite in the ore is an intimate one, with the silica usually in a finely divided state.

The proportion of these substances is not constant, so that the ores vary from a lean ferruginous chert to a rich ore containing upwards of sixty per cent of iron. Large quantities of the better ores occur in the lower beds of the division. The occurrence of these ores between the beds of gray siliceous rock, and their intimate association with finely divided silica, point to their deposition and enrichment from the infiltrations of waters carrying solutions of iron and silica which were deposited in the waters in cracks and between the bedding of the already-

formed siliceous rocks. This mode of formation has been described by Van Hise for similar ores in the Lake Superior region.

On the three southern islands of the chain there is a gradual change in the nature of these measures. They pass into a brownish-black siliceous shale, rich in iron and containing considerable carbon as small scales of graphite. This is the form in which they are found to the southward on the islands as far as Long island. The thickness of the division is very constant on the islands northward to McTavish, but it does not occur on Cotter island.

The rocks belonging to the third division, as before stated, grade into the division above them, and the line between them cannot be drawn sharply.

The typical rock of the division is fine-grained and very siliceous, with minute particles of silica coated with red oxide of iron, forming a coarse impure red jasper.

These jasper rocks usually occur in thin broken bands, the partings between them being filled with a finely-divided mixture of hematite, magnetite and jasper. The hematite is greatly in excess of the magnetite. The association of the iron ores and the jasper is intimate, and they must have been deposited simultaneously from aqueous solutions probably leached from the cherty carbonate measures above. Microscopic sections from these rocks are almost identical with those of jaspilite figured by Van Hise in his monograph on the iron-bearing rocks of the Lake Superior region; and they must have had the same origin that he has assigned to these rocks, namely, enrichments deposited by water subsequent to the formation of the bedded rocks in which they are found as partings, and filling the most minute cavities.

The amount of ore in this admixture of hematite and jasper varies greatly. Where the ore is poor, the jaspery rock pre-

dominates and incloses lenses of hematite, while where the hematite is most plentiful it incloses similar lenses of jasper. The detailed description of these rocks shows that the measures of this division contain an immense amount of hematite. The rocks of the division do not occur on all the islands, being wanting on Flint, Belanger and Ross. On Anderson they are represented by a few thin beds not rich in ore, while on Clarke they form the summit of the section with a thickness of eighty feet. They reach their maximum development on Gillies and Taylor, where their ores are richest and most concentrated. Farther northward they become thinner and poorer in ore, being twenty feet thick on Davieau and only eight feet thick on McTavish, where they die out. No trace of these measures is found underlying the upper rocks on the islands south of the Nastapoka group.

The fourth division, consisting of red jaspilites, is an arbitrary one, of use only as a subdivision of the iron-bearing rocks. Wherever the jaspilites are well developed the richer beds are underlain with leaner measures, unfit for working, and these poorer ores constitute this division. On Clarke island these beds are twenty feet thick; on Gillies they vary from ten to twenty feet in thickness, on Taylor they are ten feet, while to the northward they merge into the overlying division, all poor in iron ores.

The richest ores are found in division III, where extensive beds several feet in thickness are found containing ore practically free from jasper, and ranging in iron values from thirty per cent to sixty per cent. Most of these ores, however, would require separation from the bands and lenses of jasper before becoming sufficiently rich to be economically treated in the furnace. The position of the ores on the islands separated from the mainland by a sound varying from a mile to four miles in width, with excellent, almost tideless, harbours, constitute ideal conditions for shipment. The mining of the ores would also be

easy and cheap, if advantage were taken of the great water-power of the Nastapoka river, which falls 160 feet into the sea within a few miles of the best ore deposits, and from which electrical power might be generated easily and cheaply. Owing to the distance of these ores from the nearest furnaces, and the want of experience in the navigation of Hudson strait, the shipment of them is at present out of the question. No coal is found in Hudson bay, so that economical smelting near the mines cannot be attempted, until electrical smelting becomes practicable some time in the future.

In all the fields where extensive areas of iron-bearing rocks occur in the Lake Superior region, the search by drilling has disclosed large deposits of concentrated ore, and there is little doubt that such a search in the Hudson bay region would lead to similar discoveries, as the manner in which the ores occur is favourable for such concentrations.

Mica.—Active mining operations for mica are being carried on at Lake harbour, on the north side of Hudson strait. This mine is being worked in connection with the whaling steamer *Active*. A number of white men are brought to the place from Scotland in the early summer, who, with the assistance of the Eskimos, work the mine, and then return home in the fall. Last summer thirteen tons of excellent mica were taken out in this manner. Other deposits of this mineral will probably be found on that coast to the westward in association with the crystalline limestones so largely developed there. A mica mine was opened some years ago on the west side of Cumberland gulf, but for some reason was shortly after abandoned.

Graphite.—Extensive bands, or veins, of this mineral were discovered by Mr. Caldwell to the south of Port Burwell along the east shore of Ungava bay. Graphite has also been found in the neighbourhood of Cape Wolstenholme, and along the east

side of Baffin island, but no attempt has been made to develop any of the outcrops.

Molybdenite.—Flattened crystals of molybdenite have been found in many localities in the pegmatite veins penetrating the Laurentian rocks, but in no place has the quantity been sufficient for mining.

There is no doubt that the combined areas of Carboniferous and Tertiary coals are very extensive, and that they would form a valuable addition to the mineral wealth of the Dominion if they were located in a more accessible region. Situated as they are in the northern Arctic islands, where navigation is at all times uncertain and unusually perilous, it is very doubtful if they will ever prove of economic value.

Lignite.—Attention has been drawn to the occurrence of lignite of an excellent quality in the sand and clay deposits of Tertiary age along the northern and eastern shores of Baffin island and on the east side of Bylot island.

Little is known of these deposits, as the only information concerning them is derived from small float specimens picked from the beds of the streams that flow over these sands and clays. These lignites probably correspond to the bituminous coal found in the folded Tertiary rocks of the far north, and may prove to be quite extensive and of economic value, as the localities at which they have been found, although within the Arctic circle, are by no means so dangerous of access as the coal beds of the north.

Coal.—The presence of extensive deposits of coal on the island north of Lancaster sound has already been mentioned in the discussion of the Carboniferous and Tertiary formations of the northern islands. The Carboniferous rocks cover all the western islands of the Parry group, and extend northwesterly into the northwest part of Ellesmere. Parry first discovered coal in the cliffs at Winter harbour on Melville island, and used

it for fuel on his ships. The Franklin search parties later found outcrops of coal in other places along the southern and eastern shores of that island and in the cliffs of Bathurst island.

These outcrops of coal indicate that the seams seen in the southern cliffs will be found extending inland over the greater portion of the islands, where they are covered by several hundred feet of newer rocks. No coal has been found in the Carboniferous rocks of Ellesmere island.

The mineral occurs in thin beds along with sandstones and shales, and is a good quality of bituminous coal.

In the folded Tertiary rocks found in the vicinity of Lady Franklin sound on the west side of Kennedy channel several outcrops of excellent bituminous coal have been discovered. The beds in the neighbourhood of Fort Conger have been mined along the outcrop and used for fuel by the Nares expedition and by Greely and Peary.

Scottish Whaler 'Eclipse.'

CHAPTER X.

WHALING.

The pursuit of the Right whale in the Arctic seas calls into play all the instincts and resources of the hunter; the dangers of ice and climate add zest to the chase, while the value of the quarry is the incentive which has brought forth all the daring and ingenuity of the whaler in his efforts to capture this most valuable and wary animal, and has caused him to assume risks unequalled in any other calling. The capture of a single whale repays the expenditure incurred in outfitting a steam whaling ship, and if more than one is killed on the voyage, it

means large dividends to the owners and small ones to the officers and crew of the ship.

Several species of whales are found in the waters of the northern ice-laden seas, but there is only one prize, known amongst other common names as the Greenland whale, Right whale and Bowhead whale, and scientifically called the *Balaena mysticetus,* L. From its mouth is obtained the precious whalebone. An average whale carries nearly a ton of this material, which at present is worth about $15,000 a ton, with the price rising from year to year. The principal uses of the whalebone are to stiffen the bodices of the better-made gowns, and to weave into expensive silk fabrics. The wealth of the world is increasing and the supply of whales is decreasing; no idea, therefore, can be formed of the value of whalebone in the future, as no good substitute has been discovered. An adult female whale will furnish blubber sufficient for nearly thirty tons of oil, while a male will supply about twenty tons; the value of oil also is on the increase, and may be taken at about $100 per ton. Thus, the total value of a large whale varies from $15,000 to $20,000, but even at that the chase is becoming unprofitable, owing to the few whales remaining, and to the frequent 'empty' voyages made of late years.

The whaling 'grounds' of the eastern side of America are situated in Davis strait and Baffin bay and in the northern parts of Hudson bay.

The memorable voyage of Baffin, in 1616, first showed the value of the whale fishery of Davis strait, and as early as 1619 the first Dutch whaler was fishing in those waters. A few years later they were joined by British whaling vessels, but their operations were confined to the waters off the south coast of Greenland for nearly two hundred years, until the voyages of Ross and Parry disclosed the more valuable waters of Baffin bay and of the western side of Davis strait.

These discoveries led to a rapid increase of the British whaling fleet, and vessels were fitted out from the ports of Hull, Dundee, Kirkcaldy, Peterhead, Fraserburg and Aberdeen.

The introduction of steamships in the early sixties, and the combination of the whale fishery with the sealing industry of Newfoundland and eastern Greenland, led to further increases in the fleet, which, in 1868, totalled thirty steam and sailing vessels as follows: Dundee, 13 steam and 1 sailing ship; Peterhead, 4 steam and 8 sailing ships; Fraserburg, 2 sailing ships; Aberdeen, 1 sailing ship; Hull, 1 steamship. This was the last year in which ships sailed from Hull; since then the British whaling fleet has been from Scotch ports only. Steam soon altogether replaced sails, so that in 1877 only the former was employed. The fleet at that time had been reduced to thirteen vessels, all sailing from the port of Dundee. No new ships have been built during the past twenty-five years, and the construction of these strong oak vessels, sheathed with greenheart or ironbark, is fast becoming a lost art in these days of steel and iron ships. The Dundee fleet is now reduced to five, without much prospect of their being replaced by British-built ships. The future ships of the whaling fleet will probably be Norwegian-built. Four of the above vessels were, in 1904, whaling in Baffin bay, the fifth was in Hudson bay.

The American whalers did not attempt Arctic whaling until 1846, and have since confined their operations to the waters on the west side of Davis strait (Cumberland gulf and southward) and to those of Hudson strait and Hudson bay.

The American ships have always been sailing vessels, and the American methods differ considerably from those of the Scotch whalers, the chief difference being that their ships are provisioned for two years, and remain one or two winters in the north on each voyage. Americans were the first to erect permanent stations in the eastern Arctics.

Crew of the American Whaler 'Era.'

The attention of the Hudson's Bay Company was early directed to the whale fishery of Hudson bay. In 1719 a frigate and sloop, under the command of Knight, were despatched from Churchill, to explore the western shores of the bay to the northward and to prosecute the whale fishery in those waters. The disastrous ending of this venture, the entire crews dying of scurvy and starvation on Marble island, put a stop to all projects of the Company as regards whale fishing, until one was undertaken in recent years, but so little success attended the venture that it was abandoned after three years' trial.

Public attention was first called to the whale fishery of Hudson bay by Dr. Rae, in the publications on his voyages in 1846 and 1854 along the northwestern coast of the bay in search of traces of the Franklin expedition.

In 1860 the first American ships visited the northwestern part of Hudson bay, wintered there, and returned with full cargoes. Their success led other whalers to the same waters, so that in 1864 there were fourteen American ships in Hudson bay and Cumberland strait.

Whaling in Hudson bay has since been almost wholly in the hands of the Americans, and an idea of the value taken by them from those waters may be obtained from the tabulated statement at the end of this article.

The first British vessel of modern times to visit Hudson bay for whales was the Newfoundland steamer *Nimrod,* which, according to Hall, was at Repulse bay in 1867. The Scotch steamer *Arctic* made two or three voyages to the bay, the last being in 1897, when she struck a rock in Hudson strait, and was damaged to such an extent that she subsequently sunk in Cumberland gulf. The Hudson's Bay Company's ship *Perseverance,* already alluded to, was in Hudson bay from 1894 to 1896, and only took five small whales. Changing hands, a couple of years later, this ship was at Cumberland gulf, and

sailing from there for Scotland must have struck an iceberg, as no tidings have since been had of her. This, or being crushed in the ice or being wrecked by striking sunken rocks upon these uncharted coasts, is the usual fate of the whaling vessels, and some such loss, entailing excessive hardships and often death upon the crews, is almost an annual occurrence in these Arctic waters, so that a high rate of remuneration is necessary to compensate for the risks.

Since 1898 the Scotch steamer *Active* has made annual voyages to Hudson bay, and has established two stations, one on the north side of Hudson strait and the other first at Southampton island, but later removed to Repulse bay. Walrus hunting was the first object of this undertaking, with whaling as a secondary consideration. Success appears to have crowned this enterprise, as in addition to a few whales, a goodly number of walrus are taken annually, and the profits of these are enhanced by the furs obtained from the natives, and by mica from a mine worked on the north shore of Hudson strait.

Whaling in Hudson bay appears to have reached its height about 1870, after which the disappearance of the whales from the more accessible waters led to a diminution of the catch, and many of the American whaling vessels were transferred to the Arctic whaling waters reached from the Pacific, which were also discovered and made known by the British ships in search of the ill-fated Franklin. At present only one of the American whalers is in Hudson bay, and none of them have visited Cumberland gulf for some years past; the only connection with the industry now on that coast is the small and unprofitable station at Cape Haven, on Cyrus Field bay, owned by a firm in Boston.

The movements of the whales appear to depend largely upon the ice of these northern waters, and that in turn is modified by the currents and configuration of the seas, so that a short geo-

graphical description is necessary to a proper understanding of the movements and habits of these animals.

Davis strait and Baffin bay separate Greenland from the great Arctic islands of Baffin, Bylot, North Devon and Ellesmere. Their combined length stretches from the mouth of Hudson strait to the entrance of Smith sound, or from latitude 60° N. to latitude 78° N., a distance of 1,200 miles. In shape they may be compared to a sack loosely drawn in about a third of the distance from its mouth, which opens widely to the southward, where it has a breadth of nearly 500 miles between the southern part of Greenland and the island of Resolution on the north side of Hudson strait. Both shores then gradually approach, until in the neighbourhood of latitude 66° N. the distance across is 200 miles. To the northward of this the Greenland coast runs nearly due north, while the western coast trends towards the northwest, and in consequence when latitude 75° N. is reached Baffin bay is nearly 400 miles wide from the Greenland coast to the shores of North Devon. Beyond this the Greenland coast sweeps to the westward, around Melville bay, and after Cape York is passed turns northwest until Cape Alexander, at the entrance to Smith sound, is reached. The western coast, in the meanwhile, first runs north and then northeast to Cape Isabella, which is only twenty-five miles distant from Cape Alexander on the Greenland coast.

Like all the great northern bays, Baffin bay has a current flowing northward along the eastern or Greenland coast, and a cold Arctic current setting southward along the western shores. These currents have a considerable influence upon the climate of the adjoining land, and the mean annual temperature at points of corresponding latitude is several degrees higher on the Greenland side. This difference of climate is marked along the middle and northern coasts, that of Greenland being practically free from ice and snow, except where glaciers from the

great central ice-cap flow down into the sea. The fiords and bays are open early in summer, while the current sweeps northward all the ice accumulated along the coast during the winter, leaving an open sea, usually early in July, as far as Melville bay.

A portion of this southern current evidently comes from the North Atlantic, and the remainder sweeps around the southern end of Greenland, bringing with it a stream of Arctic ice brought south on the Arctic current of east Greenland. This stream of ice is soon deflected from the west coast, and appears to melt in the southeastern part of Davis strait, as there is a lane of open water separating the southern ice from that of the west coast.

The distance from Wilcox head to Cape York, across Melville bay, is 180 miles; that from the centre of this line to the head of the bay is upwards of 100 miles. Much of the shore-line of the bay is still unexplored, but sufficient is known to state that it is an almost unbroken line of glaciers, which constantly discharge large icebergs into the waters of the bay. A large number of rocky islands break its surface, and the bottom appears to be very uneven, with much shallow water; in consequence, many of the icebergs are grounded in the shallower parts of the bay. The islands and grounded bergs break the winds and waves, and so allow of the formation of heavy sheets of ice between them during the winter months, while in the summer they act as anchors for this sheet, or floe ice. As before stated, the southerly current carries a great part of the shore ice of central Greenland north to Melville bay, where it acts as an aggravation to the congestion of ice there, so that it is always late in the season before the bay is even partly clear of ice, which must pass westward, until being influenced by the northern current from Smith sound, it is deflected south and goes to increase the great mass of ice known as the 'middle

pack,' which all summer fills the southwestern part of Baffin bay. In the days of sailing ships the whalers made their way across the bay by tracking, or sailing along the edge of the solid land-ice, and many a vessel was lost there. Even with steam-power this is a place of terror to the whalers, and they never feel safe until they have reached the 'north water' at Cape York. As an illustration of the dangers and difficulties of this crossing, the *Vega* was crushed and sunk in the summer of 1903, and the *Balaena* was at the same time eighty days tightly jammed in the ice. In 1904 the *Eclipse* took thirty days to cross the bay, and the *Diana* was thirty-five days in crossing. The *Neptune,* on the 8th of August, crossed in twenty hours, when little ice was seen until within a few miles of Cape York; and from there to Cape Alexander, at the entrance to Smith sound, only 'pan' or sheet ice was observed at the heads of the larger bays, all the eastern side of the northern part of Baffin bay being free of ice. This open 'north water' is caused as follows: The ice to the southward of Cape Alexander breaks up towards the end of June or early in July, and is soon carried southward on the southerly current of the west side. Smith sound and its continuation northward remain tightly frozen until August, when it sends its heavy ice southward; in consequence there is always a wide interval of open water between these two streams of ice from the north. The Smith sound ice continues to pour out in heavy floes, often square miles in area, until the end of the year, and this stream finally joins the earlier ice in the western part of Baffin bay, where other streams of Arctic ice gather from Jones, Lancaster and Ponds inlet sounds. All these form the great mass of the 'middle pack,' which slowly empties on the northern current, flowing southward along the west side of Davis strait, blocking the mouths of Cumberland gulf and Frobisher bay in the late summer, later appearing on the coast of Labrador, and finally forming the

heavy pack upon which the seals are found in March and April off the shores of Newfoundland.

The whaling grounds of Hudson bay have been confined to the north side of Hudson strait and to the northwestern part of the bay. The great island of Southampton lies in the north part of the bay and divides it into two unequal portions. The eastern or Fox channel is by far the larger, extending northward from latitude 64° to latitude 70°, and exceeds 200 miles in width. The western, or Roes Welcome, is much smaller; its length from Cape Fullerton to the head of Repulse bay is 150 miles, while it rarely exceeds 40 miles across.

In the early days of the Hudson bay fishery, whales were plentiful as far south as Marble island, and from there northward to Repulse bay. Of late years few whales have been taken in these southern waters, and the whalers now confine themselves to the southern shores of Southampton and the waters of Roes Welcome.

The northern and eastern parts of Fox channel are still unexplored, and owing to the large masses of ice found there continuously, and to the numerous shoals and reefs in the known parts, it has never been a favourite place for whalers, its waters being the only portion of the bay where the whales have been left undisturbed.

The favourite resort for whales both in Baffin and Hudson bays is along the edge of the ice still fast to the shore, with an abundance of loose ice outside. When the shore ice is all melted or loosened they prefer to remain about the edge of the large masses of floating ice. This habit of remaining close to the ice-masses appears to be due to two causes—food and protection. The whale is a very timid animal, and is easily frightened by anything out of the ordinary; it then either takes to the protection of the tightly packed ice, or leaves for distant parts. The food of the whale consists of small crustaceans (called sea-

lice by the whalers), and swimming pterepods known as 'whale-food' and 'blackberries.' These creatures in turn feed upon minute animal organisms, known as diatoms, which are found in countless numbers in these northern waters, where they are so numerous as to discolour large areas of the sea, giving it a light-green, or a brownish hue. The diatoms are known to be propagated in the fresh-water pools upon the large pans of ice, and it would appear that they thrive best in the comparatively fresh surface-water in the vicinity of melting ice; this may be the chief reason for the whales frequenting such localities.

The whales are known to enter Hudson strait early in the spring; they have been captured around Big island in April and May, and at the western end of the strait in the latter part of May. They then cross to the west side of the bay along the edge of the open water, being found in June and early July along the land-floe on both sides of the southern part of Roes Welcome. As the Welcome clears of ice they proceed north to Repulse bay, and, still later, pass through Frozen strait into Fox channel. Late in the autumn they again pass through Hudson strait going eastward. By far the greater number of whales taken in Hudson bay have been killed in the vicinity of Whale point near the southern entrance to the Welcome.

Some whales are supposed to remain during the winter in the waters of Hudson bay, as they have been reported by the Eskimos as being seen in the depth of winter off Mansfield and some of the more southern islands of the east side of the bay.

The migration of the whales in Davis strait and Baffin bay is fairly well known. In March they are found along the edge of the land-floe of Cumberland gulf and Frobisher bay, where they remain until the beginning of May, when they cross to the Greenland coast, and in June are found on the 'middle ground' to the south of Disko. From there they follow the shore ice north to Melville bay, and then cross along the southern edge

of the 'north water' to the western shores of Baffin bay. Should there be a good land-floe in Jones and Lancaster sounds, they are found there late in July and in the beginning of August, but the greater number go south to the mouth of Ponds inlet, where the principal summer catch is made. During September and October they are found along the western edge of the 'middle pack,' and the whalers pass southward from Ponds inlet, making use of a number of good harbours known only to themselves on the eastern side of Baffin island, and going out only in fine weather. According to the season they remain on that coast, to the northward of Cumberland gulf, until the middle or end of October, when they leave for Scotland. In October the whales again enter Cumberland gulf, and remain along the edge of the newly-formed land ice until December, when their position is unknown until their return in the following March. They are supposed to go in the meantime, to the southward, off the mouth of Hudson strait and along the northern Atlantic coast of Labrador, but the weather then is too severe to permit of the use of open whaleboats.

The Greenland whale, commonly called a 'fish' by the whalers, is, as all know, a mammal, warm-blooded, reproducing and suckling its young like any of the land mammals. Its outward resemblance to a fish is merely a provision of nature, whereby its shape is adapted to the conditions in which it lives; that is, for a wholly marine life. Its swimming 'fins' when stripped of their covering, are found to correspond to the fore-limbs of quadrupeds, and although the whale does not possess any hind-limbs, there are rudiments of such to be found in their place, or at least the rudiments of the pelvis to which the after limbs were attached.

In colour the whale is usually black or bluish-black above, and whitish or piebald below. Sometimes white spots occur on the upper parts, and the markings frequently vary with the individual. The young are lighter-coloured, being bluish.

An adult whale varies from forty to sixty feet in length; extra large ones run to sixty-five feet, and the largest recorded reached eighty feet in length.

The whalers have different names for differently sized whales. *Suckers* are the young under a year old; *Shortheads* is also applied to the young as long as they continue to be suckled. *Stunts* are two years old; *Scull-fish* have bone less than six feet in length; *Size-fish* have the bone exceeding that length.

The following are the measurements given by Dr. Robert Goodsir of a large female whale killed in Ponds bay:—

	ft.	in.
Length from the fork of the tail, along the abdomen, to tip of lower jaw	65	0
Girth behind swimming-paws	30	0
Breadth of tail, from tip to tip	24	0
Greatest breadth between lower jaws	10	0
Length of head, measured in a line from articulation of lower jaw	21	0
Length of vulva	1	2
From posterior end of vulva to anus	0	6
From anterior end of vulva to umbilicus	8	0
Mammæ placed opposite the anterior third of vulva and six inches from tip of it		
Length of sulcus of mammæ	0	3
Breadth of sulcus, on each side of it	0	2
From tuberosity of humerus to point of pectoral fin	8	0
Greatest breadth of fin	3	11
Depth of lip (interior of lower)	4	7
From the inner canthus of eye to extreme angle of fold of mouth	1	5
From inner to outer canthus	0	6
Length of block of laminæ beleen, measuring round the curve of the gum, after being removed from the head	16	6
Length of longest lamina on each side	10	6
Distance between the laminæ at the gum	0	0$\frac{7}{8}$
Breadth of pulp cavity of largest lamina	1	0
Average length of pulp when extracted from one side of the largest laminæ	0	5

Number of laminæ on either side, about 360.

Female whales are larger and fatter than the males, so that a female will have an average of about ten more tons of blubber than an ordinary male. As will be seen from the above measurements, the head equals about a third of the length of the body, and the upper jaw, which carries the baleen or whalebone, is only a few feet shorter. The baleen is in the form of thin slabs or 'splits' set close together in the gum at right-angles to the length of the jaw-bone. At the base the splits are from six to twelve inches wide and from a quarter to nearly an inch in thickness. They taper slowly to their free end, and terminate in long hairs which extend upwards of six inches beyond the solid bone. Similar hairs are found along the inside of the bone. There are about 360 of these splits on each side of the jaw, and they are placed so as to slope backwards. The longest or 'size split' is in the middle of the side of the jaw, and the others decrease in length in front and behind. It derives its name from being the split by which the length and weight of the bone is computed. The longest split recorded measured fourteen feet in length, but the ordinary length in adult whales is from nine to ten feet. Bone of that length will average nearly a ton weight to a whale. Bone six feet and under brings only half the price of longer bone. The laminæ are usually pale-blue; in the young they are sometimes green and black; in older whales nearly black, and occasionally striped white and black.

This bone in the whale's mouth acts as a swab or sieve to entangle and collect the small animals upon which it feeds. The lower lip is very deep, and when closed fits close to the head, the edge forming a bow as it curves backwards from the front. When feeding, this lip is let down, so that it projects nearly at right-angles, forming a sort of trough and conducting the water, as the whale moves through it, to the tangle of hairs of the exposed bone. When sufficient food has been collected the lip is closed and the food removed from the baleen by the broad

Bundles of Whalebone on the 'Era.'

tongue. A whale when feeding travels at, or near the surface, at a rate varying from two to four miles an hour. The speed at which a free whale travels through the water appears to have been greatly exaggerated. When harpooned, and dragging a whaleboat, the speed rarely exceeds six miles an hour, and as the mass of the whale greatly exceeds that of the boat the latter cannot to any great extent retard its speed, especially as the whale is then exerting its utmost power in its efforts to escape.

The body is everywhere covered with a thick skin, which varies from an inch to an inch and a half in thickness. This thick 'blackskin' forms a luxury in the diet of the Eskimos and whalers. It is eaten boiled, a small amount of blubber being attached to give it flavour. When cooked it has the appearance of thick black india-rubber, and is soft and glutinous, while its flavour approaches that of the clam.

The fat or blubber is found everywhere directly below the skin, and is thickest towards the tail. It bears a resemblance to very fat pork, and is from twelve to eighteen inches in thickness. The flesh of the whale is coarse and tough, and is used largely for dog-food; although often eaten by the Eskimos, it is only when seal or walrus meat cannot be obtained.

Whales are gregarious, and when plentiful travel in large bands, but they are now so rare that a band of three or four is the greatest number seen together of late years.

There are two methods employed in the chase after whales. The Scotch whalers of Baffin bay cruise about in small steamers, and depend wholly upon their own white crew to man their boats. The American whalers and the stations depend more or less upon the Eskimos to form their boats' crews.

The Scotch steamers are small, stout vessels, from 300 to 400 tons register. Those, British-built, are of hardwood throughout, while the Norwegian ships have hardwood frames and soft-

wood planking. The timbers and planking in all are very heavy, and the sides are further strengthened by a sheathing of greenheart or ironbark, both exceedingly hard, tough woods. This sheathing extends from above the water-line to near the keel; the planks forming it are from three to six inches thick, and are capable of resisting great pressure from the ice, as well as withstanding its cutting action which would soon wear through unprotected sides. The bows are further strengthened by being backed by several feet of solid timber, while, outside, thick plates and bands of iron protect the bow and stem. The sides are also strengthened by a layer of rock-salt, filled in between the timbers and between the skin of the ship, and by an inside sheathing fastened to the timber, so that with the outside sheathing of greenheart, the planking and the salt-filling, the sides are from eighteen to twenty-four inches thick. Notwithstanding this great strength, the usual fate of these ships is to be crushed in the ice.

The ships are three-masted and barque rigged, differing in appearance from an ordinary wooden barque by the presence of large barrels fitted to the tops of the fore and main masts, and used for observation stations when working the ship through ice or when chasing whales. The small engine and boiler are placed aft, between the main and mizzen masts, where the strong deck beams can be best spared. The engine works a two-bladed propeller, which drives the ships at rates varying from four to seven knots an hour.

The lower hold of the ship is filled with a number of iron tanks that rise to the level of the middle deck, and which are used to store the blubber. On leaving home all these tanks are filled with coal, which is also stowed in every other available space, the usual amount of coal for the voyage being from 250 to 300 tons. The between-deck space is used for stowing provisions, and for the quarters of part of the crew.

The officers and crew usually number about fifty persons, sufficient to man six whaleboats and to leave men on board to work the vessel.

The boats are narrow, and are pointed at both ends. Their length is about twenty-six feet. They are propelled by five oars, or by sail. When rowing the steersman uses a long sweep oar, and when sailing a rudder, so arranged as to be easily unshipped and hung on the side of the boat. Scotch whaleboats are built of larch, while the American are made of cedar. Another difference is that the latter are centre-board boats, while the former have fixed keels.

On the whaling grounds the boats hang ready in davits, three on a side, with all their whaling gear in place, and ready to be lowered at a moment's notice. A man is always on the look-out in the barrel, and when a whale is sighted the captain takes his place there and directs the movements of the boats from the ship by signals made with sails and other signs. He is also in connection with the engine-room, and controls the ship from that lofty perch.

A whale is usually sighted by the column of spray which it throws up in breathing, and which often rises twenty feet in the air, accompanied by a puffing sound. A whale usually spouts or breathes five or six times when it comes to the surface for that purpose, and so remains up for several minutes. It then goes down to feed, and remains under the water for fifteen or twenty minutes, during that time travelling perhaps at most a mile. If possible, advantage is taken of the wind to approach the whale, to avoid the noise made in rowing. For that purpose ordinary metal row-locks are not used, their place being taken by stout pins, to which the oar is attached by a 'grummet' or loop of rope. Both ear and eye of the whale are very small, but in the water they are very acute, and any strange noise instantly arouses suspicion. The eye is so placed that the animal can

only see ahead, and care is therefore taken to approach it from behind.

The Scotch whalers use guns, both for the harpoon and for the bomb, with which the whale is killed after the harpoon is fast. The harpoon has but one barb, and is so attached to the shank that when it has entered the skin and the line begins to pull, it swings at right-angles to the wound, and cannot be removed without cutting a large hole. The shank is about two feet long, and is split from the head to butt. In this split runs a ring to which the line is attached. The butt is a circular disc the diameter of the bore of the harpoon gun. This gun is mounted on a stanchion in the bow of the boat, and, working on a swivel, may be pointed in any direction. It is a muzzle-loader, and its discharge is insured by a double primer. When the gun is loaded, only the head of the harpoon and a short length of the stock protrude, sufficient for the ring with attached line. When it is fired the ring slips back to the butt and the head is buried deep into the side of the whale.

The harpoon line is generally made of manilla, and has a circumference of about three inches. It is carefully coiled in tubs between the seats, each tub holding a line 120 fathoms long. After the whale has been struck, the line is passed aft and a turn taken around a post in the stern, from which the line is payed out as required. The bomb gun has a bore about an inch in diameter, and fires an explosive shell, so arranged as to explode shortly after coming in contact with the body of the whale, and thus well inside. This gun is rarely used before the whale makes its first plunge, and frequently several dives are made before the boat can get close enough to give this *coup de grace.*

As soon as life is extinct, the boats form in line and tow the whale, tail first, to the ship, where its tail is made fast to the quarter, and an effort is made to reach a harbour, where the car-

Preparing for Spring Whaling.

cass may be stripped with safety. When this is impossible, the body is brought alongside the ship and secured by the head and tail. Work is then commenced with long-handled blubber spades, about six inches wide and very sharp. The blubber is removed in long strips cut around the body, and when one side is finished the whale is turned over. The great lips are cut away, and then, with cheers, the prize in the upper jaw is hoisted on board. The blubber, as it is taken from the whale, is stored in the empty tanks and is taken home in this condition. It is not reduced to oil immediately, as is the practice with the Americans.

The Scotch whalers of Hudson bay differ in their methods from those of Baffin bay only in the employment of Eskimos to man a part of their boats, and consequently they do not carry so large a white crew. The natives employed by the *Active* belong to the north side of Hudson strait and come from the vicinity of Big island. Several families of these Eskimos are taken on board the ship when she arrives in the early summer, and remain on board until she leaves for home in October. These natives are employed partly in whaling and walrus hunting, and are very useful in skinning and preparing the hides of the walrus.

At present there is only one American vessel engaged in whaling on the eastern side of America, the topsail schooner *Era* of New Bedford. This ship entered Hudson bay during the summer of 1903, wintered in the harbour of Fullerton, and intended to pass the winter of 1904 in the same harbour, returning home in the following September. As the *Neptune* wintered alongside at Fullerton, and as the writer made a trip lasting two weeks to Southampton island, in June, 1904, in company with four of the whaleboats belonging to the *Era,* he is personally better acquainted with the life and methods of the American than with those of the Scotch whalers.

The *Era* is over fifty years old, and was originally built for a coasting packet. When her usefulness in that trade was passed, some thirty years ago, she was sheathed with about three inches of hardwood, and further reinforced with iron plate in the bow. Little expenditure seems to have since been made by the owners. The ship is now very leaky, and in such a condition that she could not get a British rating. During the winter, when tightly frozen in, the pumps were going daily, and when at sea they are almost constantly going to keep the vessel afloat, while the forecastle, the home of a crew of twelve men, has several inches of water on the floor, and every bunk is soaking wet. This forecastle is very small, and when the small stove and table are set up, the men have to crawl over one another to get to their small double-decked bunks. The air is exceedingly bad, and these quarters probably account, in part, for the scurvy prevalent amongst the crew. The food is as antiquated as the accommodation, and is confined to the staples, barrelled pork and beef with biscuit left over from the Spanish-American war, and returned from Cuba more or less alive; to these are added coffee and molasses of the cheapest kind, and a small quantity of tinned meats, preserved potatoes and dried apples, none in quantities sufficient for anything approaching a daily ration; no antiscorbutics, such as lime-juice, are carried. These antiquated rations are supplemented by fresh meat of the deer, seal and walrus obtained from the natives, but during the winter this supply is often very inadequate.

The officers and crew numbered twenty on leaving New Bedford. They consist of the captain, two mates, three boat-steerers, cook, steward and twelve seamen. None of the officers hold certificates, and as far as their qualifications to navigate the ship are concerned, have passed no official test.

The officers and boat-steerers are 'old hands,' having made previous voyages, either to Hudson bay or to the western whal-

ing. The crew are all landsmen without any knowledge of the sea, and are obtained for the voyage through the agency of crimps. Some were signed on under false statements and others put on board while drunk. In some cases the ship's articles were signed after the vessel was at sea, and the majority of the men when they signed had not had the articles read to them. Advances made by the crimps at extravagant rates are paid by the owners without the knowledge or consent of the crew as soon as the vessel leaves port. No wages are paid, all being on shares; and the share of the crew is so small and the advance account and articles supplied from the 'slop-chest' so great that it is the usual thing for each man to find himself in debt to the owners on his return from no matter how successful a voyage. None of these practices are allowed on board the British vessel, and the crew are not only paid monthly wages, but participate in the profits of the voyage.

The *Era's* crew was composed of a gunsmith, a clerk in a wholesale drug business, an iron moulder, a mechanic, an ex-soldier, a railway brakesman, an Armenian and several non-descripts 'about town.' Of the entire lot only one had ever been to sea before.

The treatment of the crew by the officers was as good as circumstances permitted, and was in strong contrast to their general treatment by the owners.

The methods of the American whalers differ considerably from those already described. When the ship arrives in the northwestern part of the bay, the Aivillik Eskimos are looked for somewhere in the vicinity of Whale point, and enough men, practically half of the tribe, are engaged for the time the ship remains in the bay. The ship's crew are sufficient to man three whaleboats, and three others are manned by the natives. Four boats are brought on the ship every voyage, and only two are taken home, the other two, equipped for whaling, being left with

the natives, and any whales caught during the ship's absence are supposed to belong to the ship furnishing the boats.

The natives and their families and dogs are taken on board the schooner and conveyed to the harbour where it is proposed to spend the winter. About seventy persons of this tribe were at Fullerton during the winter of 1903-04, and twice a day received a meal of biscuit and coffee on the ship. These people were fed in the cabin after the officers, and two or three extra tables were required to accommodate all, so that the meal continued for nearly two hours, and the atmosphere of the cabin was anything but sweet. No regular wages are paid to the natives either during the winter when hunting, or when in the boats in the summer, but they are given such articles as the captain thinks they should have or deserve, everything being left to his judgment or caprice. On the whole they are fairly well treated, and although they only get a very small percentage of their catch, still the presence of the whaler ensures them from starvation, and provides them with boats, guns and ammunition, all of which would otherwise be difficult or impossible to obtain.

While with the ship the entire hunt of the natives is supposed to belong to the ship, and no definite payment is made for whales or fur taken during that period.

During past years a goodly number of boats have been left to the natives by the American whalers, and at the present time the Eskimos scattered from Chesterfield inlet to Repulse bay must have upwards of twenty serviceable boats. The Aivilliks have for so long become possessed of boats in this manner, that they have lost the art of building kyaks, and none of the younger men know anything about handling these craft.

Very little use is made of the ship in the catching of whales, and it usually only serves as a convenient base of supply, or as a means of transport from one locality to another.

Whaleboats on the Ice, in Roes Welcome.

As the crews live during the greater part of the open season in the boats, these are fitted with cotton covers supported on hoops, and are thus completely roofed in, affording very comfortable if somewhat cramped quarters. Cooking is done with oil stoves, and sleeping is arranged for by placing wide boards across the intervals between seats. The boats leave the ship early in May, long before the ice along the coast begins to break up, and they cruise up and down along the edge of the solid land-floe looking for whales. During stormy weather, and at night, the boats are drawn out on the smooth ice, props are placed on each side to keep them upright, and the cover being drawn on and snugly secured, afford secure and comfortable quarters, provided that the temperature does not drop too low; in that case, resort is made to the deerskin sleeping bags for greater warmth.

The west coast of the bay is patrolled in this manner until about the middle of June, the cruise extending from Chesterfield inlet to Whale point, supplies being renewed every week or so. Each of the ship's boats is in charge of an officer, who always attends to the steering. The 'boat-steerers' are in reality the harpooners, and have nothing to do with the steering of the boat.

Towards the end of June the boats cross through the floating ice to Southampton island, where they remain until compelled to return for fresh supplies, usually about three weeks. A second trip to that island is sometimes made, and in August the ship, now free from the ice, is taken to Repulse bay or the Frozen strait connecting it with Fox channel. The ship is again left in harbour under the charge of the cook and steward, and the boats cruise about until the beginning of September, when the ship is taken to winter quarters or sails for home. If the intention is to remain all winter, the harbour is reached before the middle of the month.

This is the routine, and it is only varied by the capture of a whale. As will be seen from the above description, the boats cruise nearly all the time in the in-shore waters, and the greater number of whales are taken within the three-mile limit, and not on the high seas as is the rule in Baffin bay. If the whale is killed within reasonable distance of the ship, it is either towed alongside by the boats, or the ship comes for it, and an endeavour is made to get the body into a safe harbour in order to save the blubber. A number of whales are killed in inconvenient places, and only the bone is then taken, all the blubber going to waste. When the blubber is taken, it is immediately cut up and 'tried out' into oil on board the ship, a large boiler being carried for that purpose. The hold of the schooner is filled with large casks, made in different sizes to fit the shape of the hold. On the outward voyage these are partly filled with the provisions; returning, they carry the oil and furs collected on the voyage.

During the long winter a part of the natives remain at the ship, and are employed hunting seals, walrus, and deer to help feed the women and children and the crew of the ship. The remainder are sent away after musk-ox, and remain away several months, having to go a long distance before reaching the country where those animals are found. A successful party will return with at least twenty musk-ox skins, and these add to the profits of the voyage. Stranger Eskimos also visit the ship to trade, and in this manner a considerable number of musk-ox, fox, wolf, bear and wolverine skins are added.

Unlike the Scotch whalers, where the captain remains on board ship to direct the movements of the boats from the barrel, the American captain goes in charge of one of the boats. This works well in open water, but when the whale is among loose ice very little can be seen from the boats.

The Americans make use of a hand harpoon, and as it is very heavy and has a gun attached to it, the boat must approach

Scottish Whaling Station at Blacklead Island.

within a few feet of the whale before it can be thrown with any certainty of success; otherwise the manner of capture is similar to that already described.

Station whaling, which is very similar to that practised by the American ships, is carried on both in Baffin bay and Hudson bay. The stations are either permanent establishments on land, or are small ships that remain constantly in the country, and serve only as a convenient dwelling for the small number of whites with each.

At the present time land stations are operated at Kekerten and Blacklead, in Cumberland gulf and at Cape Haven, all on the east side of Davis strait. At the mouth of Ponds inlet in Baffin bay a small ketch is stationed; in Repulse bay a similar vessel is used as a whaling station. With the exception of Cape Haven these are owned in Scotland, the Cape Haven station belonging to a firm in Boston, U.S.

Only one or two white men are employed at each, and the whaling is altogether in the hands of the natives.

None of these stations are making great profits, and some of them are being maintained at a loss. They are of great assistance to the natives, and it is to be hoped that nothing will be done to discourage the owners, who according to present returns should be helped rather than hindered in their work.

The natives have for years looked for assistance to the whalers both on Baffin island and Hudson bay. They have quite given up the use of their primitive weapons, and there is no doubt that a withdrawal of the whalers would lead to great hardship and many deaths among these people if the Government did not in some manner take their place and supply the Eskimos with the necessary guns and ammunition.

The influence of the whalers upon the natives does not appear to have been as bad as in the western part of the Arctics. The excessive use of alcohol has never been practised, and has now

been totally stopped. Disease due to sexual intercourse has been introduced and has, no doubt, led to many deaths. Other diseases introduced have carried away numbers of these people. It is doubtful if the morals of the Eskimo, which are of a different standard from those of Europeans, have deteriorated through sexual intercourse with the sailors.

The future of the whaling industry appears to be very gloomy. The annual catch is decreasing regularly, and only the high price of whalebone makes it at all profitable. No certainty of a single whale can be had, and the enterprise is reduced to almost a gambling chance. During the past season the following returns were collected from the various ships and stations visited:—

Era.—One small whale taken at Southampton up to the 20th July. To this must be added the bone of a large and small whale taken by natives before the *Era's* arrival in 1903.

Balaena.—One medium whale, three-quarters of a ton of whalebone, to 23rd August.

Diana.—Three whales, two and a quarter tons of whalebone to 23rd August.

Eclipse.—Two whales, one and a half tons of whalebone, to 23rd August.

Windward.—One whale, three-quarters of a ton of whalebone, to 23rd August.

Ponds inlet station.—Two small whales, a quarter of a ton of short whalebone, to 23rd August.

Kekerten station.—No whales to 1st September.

Blacklead station.—No whales to 1st September.

Cape Haven station.—No whales to 1st September.

Active.—One whale, 1,300 pounds bone.

Repulse bay station.—One small whale, 500 pounds bone.

Several other species of the larger whales are known to frequent the southern and eastern waters of Davis strait and Baffin bay, but do not go into the densely ice-covered seas of the western side, nor are they found in Hudson strait or bay.

None of these whales possess the precious whalebone. They are also of comparatively little value for oil, and only when hunted by steamers in conjunction with shore factories, where all the products can be turned to profitable account, as is done in Norway and Newfoundland, can the chase for them be profitable. Such ships and stations will require to be operated from the Greenland coast.

The following species of whales are the most common and important:—

Physalus antiquorum, Flem.—Big Finner, is found in Davis strait, chiefly on the cod-banks, where it devours immense numbers of fish. For its size it gives a remarkably small quantity of oil. On this account it is not killed by the whalers, and seldom by the natives.

Balaenoptera sibbaldii. Gray.—This whale is usually confounded with the one last mentioned; has the same range and habits, and is rarely killed by the natives.

Balaenoptera rostrata, Fab.—The Little Finner has the same range as the above, being well known to the Eskimos of Greenland and unknown to those of Baffin island.

Megaptera longimana, Gray.—The Humpback, appears on the Greenland coast in summer. Its whalebone is very short and of a poor quality, so that its price in no way compares with that of the Right whale. The blubber also is poor and makes little oil in comparison to its size.

Orca gladiator, Sund.—The Killer (Grampus, or Swordfish), is very voracious, and lives largely upon fish, seals, porpoises and white whales. It also attacks large Right whales, and on

this account is disliked by the whalers, as the presence of a single Killer means the immediate flight of all creatures in that vicinity. Luckily it will not penetrate among the heavy floes, where the Right whales retreat for safety, Some idea of the destruction to life caused by the Killer may be formed from the fact that in the stomach of one were found fourteen porpoises and fourteen large seals; it choked to death swallowing the fifteenth. They chase seals and White whales on shore, and the seals are often seen jumping clear out of water in their endeavour to escape.

PORPOISES.

Phocaena communis, Brookes.—The porpoise arrives on the Greenland coast early in the spring, but does not go north of latitude 69° N., nor does it frequent the ice-laden seas of Baffin bay; it is unknown in Hudson strait and bay.

Beluga catadon, Gray.—The White whale or White porpoise (Kellulauak, Eskimo) is common to all the Arctic coasts, and remains throughout the year. It usually travels in large schools, frequenting the bays and mouths of rivers. In the north large numbers have been taken by the whalers along the coast of North Somerset, both in Prince Regent inlet and in Barrow strait. It is plentiful in the rivers at the heads of Cumberland gulf and Frobisher bay. Many are killed annually by the natives along the south shore of Hudson strait. The Hudson's Bay Company has for several years past made successful fisheries in the mouth of the Koksoak river and in Leaf bay, both in the southwest part of Ungava bay. Similar fisheries were formerly conducted in the mouths of Great and Little Whale rivers on the east side of Hudson bay, but after some success the whales would not enter these rivers over the nets, and the fisheries were abandoned. The writer has seen great numbers of White whales in the mouths of the rivers to the northward of

Little Whale river, notably so in that of the Nastapoka. The Eskimos depend upon the White whale for part of their food and lamp oil. The meat is coarse and dark, being, like that of the seals, highly charged with blood and having a fishy flavour. The boiled skin is a native dainty, and is in the same class as beaver-tail or moose nose, soft and gelatinous. There is little doubt that, with the opening of Hudson bay, the White whale fishery will become an important industry in many places in the bay and strait, and also along the coast to the northward.

Monodon monoceras, Linn.—The Narwhal has habits very similar to those of the White whale. It generally travels in bands, and appears to prefer the proximity of ice, so that its summer range is more northern than that of the White whale. The Baffin bay whalers obtain a considerable number of narwhal horns from the natives of north Greenland, the best place being in the vicinity of Cape York, or to the eastward of Melville bay.

The narwhal appears to replace the White whale in the waters of Ponds inlet, only the former being killed there. Numbers are taken in the ice by the whalers of Baffin bay; they are not uncommon about Cumberland gulf when the ice still covers its waters. The natives of Hudson strait kill numbers of these animals in the early summer, and after the shore-ice has formed in the early winter, but none are seen on the south shore during the open waters of summer. The narwhal is only found in the northern waters of Hudson bay, where it is abundant in the ice-laden waters of Fox channel and Frozen strait.

The narwhal is distinguished in the water from the White whale by its darker colour, its white spots and its horn. The colour becomes lighter with age, so that very old individuals become dirty white. According to the Eskimos, the horn is confined to the males, and its chief use is for domestic battle. Only one horn is usually developed, growing out of the upper

jaw, and projecting directly forward. A second horn on the other side of the jaw is not uncommon, but it is always shorter, and is often malformed or rudimentary. The horns vary in length up to eight feet, and are composed of a very fine quality of ivory. At the base the average thickness is from two to three inches; it tapers gradually to a point, having a spiral twist throughout the length. There is a large pith core at the base, which gradually fills after the horn has reached maturity, so that in old animals the horn is almost completely solid. This ivory is much more valuable than that obtained from the tusks of the walrus, being worth from $2.50 to $3 a pound. The ultimate destination of the ivory is China, where it is used for ornamental purposes as well as for medicine, and for the manufacture of cups supposed to absorb all poisons placed in them.

The flesh and skin of the narwhal are put to the same uses by the Eskimos as those of the White whale.

TABULATED STATEMENT of information concerning the Whale Fishery in Baffin bay and in Hudson bay.

BRITISH WHALING FLEET.*

Year.	Steamer.	Sail.	Whales.	Oil.	Bone.
				Tons.	Cwt.
1865	11	12	66	742	710
1866	15	11	81	848	933
1867	17	11	24	228	60
1868	18	12	134	1,228	1,164
1869	16	10	22	266	207
1870	14	8	79	962	1,111
1871	15	6	152	1,348	1,544
1872	17	5	138	1,393	1,486
1873	18	4	172	1,426	1,475
1874	16	3	190	1,662	1,680
1875	18	2	98	975	970
1876	17	3	82	1,115	1,132
1877	13	....	81	955	850
1881	11	....	48	514	495
1882	9	....	79	670	560
1883	6	....	17	524	190
1884	9	....	79	755	780
1885	12	....	28	359	200
1886	8	....	15	375	240
1887	8	....	....	496	140
1888	7	....	6	308	43
1889	3	....	8	125	110
1890	5	....	11	403	265
1891	5	....	6	167	70
1892	5	....	7	228	78
1893	4	....	30	391	410
1894	5	....	15	218	250
1895	5	....	3	233	36
1896	3	....	3	60	15
1897	3	....	8	102	110
1898	4	....	8	235	100
1899	7	....	26	419	330
1900	7	....	17	290	230
1901	6	....	15	260	164
1902	6	....	13	212	187
1903	6	....	14	145	175
1904	6	....	11	110	107

*The returns from 1865 to 1877, inclusive, are from the Report of the U. S. Consul at Dundee, 1877. The returns from 1881 to 1904 have been furnished by Captain W. F. Milne, of the British whaler *Eclipse*.

AMERICAN WHALING FLEET.

1846–52—One ship yearly to Cumberland gulf. 350 tons oil and 2·5 tons bone.
1853–58—Five ships " " 750 " 5·75 "
1860—First two ships to winter in Hudson bay. Value of catch $60,000.
1863—Fourteen ships in Hudson bay and Cumberland gulf.
1864—Fifteen ships in Hudson bay.
1865—Two ships in Repulse bay. Killed 8 whales.
1866—Four ships wintered in Repulse bay. Little success.

HUDSON BAY.

1889—One ship.			
1890—			
1891—One ship,	4 whales,	4,400 lbs.	bone.
1892—One ship,	2 "	1,600	"
1893—Two ships,	8 "	18,500	"
1894—One ship,	8 "	4,500	"
1895—Three ships,	6 "	10,300	"
1896—Two ships,	4 "	4,100	"
1897—Three ships,	19 "	20,175	"
1898—			
1899—One ship,	6 whales,	6,000 lbs.	bone.
1900—One ship,	8 "	7,500	"
1901—One ship.	Burnt.		
1902—			
1903—Two ships,	2 whales,	1,800 lbs.	bone.
1904—One ship,	1 "	500	"

The information to 1866 has been taken from the narrative of C. F. Hall's second Arctic expedition. That from 1889 to 1904 has been furnished by Captain George Comer, American whaler *Era*.

Eight American whaling ships have, to the knowledge of Captain Comer, been lost in Hudson Bay.

SEALS.

There exists at present considerable confusion in the number of species and the classification of the northern seals. A scientific argument on classification is beyond the province of this report, and it need only be mentioned that, after careful inquiry from the Eskimos of Baffin island and Hudson bay, there is no doubt that, including the walrus, there are but six species of seals in the northern seas of eastern America, and that the other species named are simply due to varieties of age, size and colour.

The present account is confined to the distribution, habits and uses of these animals.

Callocephalus vitulinus, Linn.—The Harbour seal, Fresh-water seal, or Ranger (Kassigiak, Eskimo), is common but not plentiful on all the coasts. It is found usually about the mouths of rivers, and in bays and fiords. It is also found in some of the larger lakes of Labrador and Baffin island. These lakes are often far inland and high above the present level of the sea, and there is no doubt that in a number of them the seals reside permanently. The young, unlike those of the other seals, are produced in July on the rocks about the banks of rivers.

The skins are prized by the natives owing to their fur-like character and beauty of colour. They are dressed with the hair on, and are chiefly used for women's garments, fancy bags and for the boot-legs of dandies.

The flesh and blubber, especially of the older and larger freshwater seals, have a disagreeable odour and taste, and consequently are not so highly prized by the natives as are those of the following species.

Pagomys foetidus, Fab.—The Ringed seal, or Jar (Nietshik, Eskimo), is the common small seal of all the coasts.

The variations in size, markings and colour, due to age, have led to this seal being classed under several species.

Its flesh is the chief article of diet of the natives the year round, while its skin when dressed with the hair is used for clothing, tentings and bags; when dressed by removing the hair, it is used as covering for the kyak and for boot-legs. The blubber, burned in stone lamps, is the chief source of artificial heat.

The young are born in March in snow-houses scraped out by the female from a snow-bank, close to an air-hole on the ice. When born they have a glistening white coat of soft hair.

Pagophilus groenlandicus, Mull.—The Harp seal, Saddle-back, Bedlamiers, (Kirolik, Eskimo,) supplies fully two-thirds of the seals taken annually off the coasts of Newfoundland in the spring, when the females give birth to their young on the floating ice of the Arctic pack. The Harp seal is more or less common on the northern coasts, and southward along the Atlantic coast of Labrador, at all seasons. In Hudson strait they are rare in summer, but are not uncommon after the shore-ice forms in the autumn, and before it leaves in the early summer. These seals commonly travel in bands, and are known by their habit of frequently leaping from the water. They are

rare in Hudson bay, especially during the summer season, and are only occasionally seen at other times.

The flesh and blubber are used by the natives for food and fuel. The skins are used mostly for tentings and boot-legs, and where the skin of the Ground seal is not available for boot-bottoms.

Phoca barbata, Fab.—The Bearded seal, Big seal, Ground seal, Square-flipper, (Oujuk, Eskimo,) is common on all the coasts, and is the most abundant seal at Cape Haven, and Cape Chidley on the eastern coast.

It brings forth its young, which are born near an opening in the shore-ice, about a month later than the Ringed seal. This seal is next in size to the walrus, and its capture always brings gladness to the Eskimos, providing, as it does, a large amount of meat and blubber, while from its hide is cut an exceedingly strong line used for dog-traces and other purposes. The dressed skin is used for the soles of boots, for covering kyaks and women's boats, for tentings, and many other purposes. The flesh is coarser in texture, but less fishy in flavour, than that of the smaller seals. The liver is said to be somewhat poisonous, and is not often eaten.

Cystophera cristata, Erxl.—The Hooded seal, or Bladder-nose, (Nietshivok, Eskimo,) is a large and ferocious seal, second in size only to the Big seal. It produces its young about two weeks later than the Harps, and usually on ice farther off the coast. These seals make up the remainder of the catch of the Newfoundland sealers. In the summer they are common at Ponds inlet, and become rarer along the coasts to the southward. The Hooded seal is unknown to the natives of Hudson bay, and is an exceedingly rare visitor in Hudson strait.

Trichechus rosmarus, Linn.—The walrus, (Aivik, Eskimo,) is found in all the northern waters, where it appears to prefer the presence of floating ice, and rarely or never comes out on the

shore-ice. During the past voyage of the *Neptune* many walrus were seen; the most northern locality was at the entrance to Smith sound, where large numbers were congregated on pans of floating ice, between Etah and Cape Sabine. Numbers were seen along the coast of Ellesmere island and in the waters of Lancaster sound. The whalers and natives report them as very plentiful in Wellington channel. They are common along the coast of Baffin island, a considerable number being killed annually at the station at Cape Haven, and in Cumberland gulf. They are very numerous in Fox channel and Frozen strait, where they are captured while on the floating ice usually found in these localities throughout the summer. When the ice leaves Hudson bay and Hudson strait, the walrus resort to favourite localities, usually small rocky islands, where they are frequently found in large numbers. Such islands are located in King sound, near Douglas harbour, on the south side of the strait; at the west end of Charles island, also in the strait; at Walrus island in Fisher strait, and at several small islands of the Belcher and other outer islands of the east coast of Hudson bay.

When the St. Lawrence was discovered the walrus was found as far south as the Magdalen islands, and, within a comparatively recent time, they were common on the Atlantic coast of Labrador; now they are only killed rarely at Cape Chidley, the northern point of that coast. On Hudson bay they were formerly found as far south as Paint islands on the east side of James bay, but now they do not frequent that coast south of latitude 60° N., and their southern limit is about latitude 57° N., on the Belcher islands. There has been a rapid diminution in the number of walrus in the northern part of the bay during the past few years, since the *Active* has been engaged in their capture, and it is only a question of a few years, if the present methods of killing are continued, before the walrus will become as rare as the Right whale in the waters

of Hudson bay. It is acknowledged that, with present methods of capture and the difficulties of the chase, only one in four or five of the animals killed is eventually secured. The walrus is necessary for the subsistence of the northern Eskimo and his dogs. The flesh is strong and sustaining, the blubber is abundant and good, while the tusks are of great use for shoeing sleds and the manufacture of spears and harpoons, and other hunting and domestic gear. The present value of the walrus to civilization is small. Oil is made from the blubber, and the skins are used chiefly for 'buffing' metal goods. The ivory of the tusks is inferior, and only worth about fifty cents a pound. The present price for hides is from eight to ten cents a pound, and consequently the entire products of a large walrus is under fifty dollars in value.

Taking into consideration the value of the animal to the native, the great waste of life in the killing, and the comparative small value to civilization, it might be well to pass regulations reserving this animal wholly for the use of the Eskimos.

The Launch.

CHAPTER XI.

NAVIGATION OF HUDSON BAY.

The question of the navigation of Hudson bay and Hudson strait has been before the Canadian public for a period extending back almost to the time of Confederation. An answer to this question has become more and more pressing, as the latent wealth of the grain-fields of the Northwest has been proved, and as the present means of transport of this great volume of grain to the eastward become yearly less capable of handling it expeditiously and cheaply.

Within the past few years the yield of Northwest grain has increased enormously, and a second line of rails is being

laid across the continent to aid in the rapid transport of this wealth to the seaboard. If the increase in the area of land opened annually to cultivation continues as at present, a few years will show such a volume of grain to be transported that the new outlets will be unable to give free exit to it, and a new lane by which it can be taken to the European markets must be found.

The route by rail to the port of Churchill, on the western side of Hudson bay, and from thence to Europe in ships, is the shortest, and is likely to prove the best, of all those outside the present routes by rail to the headwaters of the St. Lawrence navigation.

Ships go wherever cargoes can be obtained, and all that is needed to open Hudson bay for ordinary commercial navigation is a line of rails to carry freight to one of its ports. At present the Hudson's Bay Company and the Revillon Fur Company have ships going annually to the bay, and a greater amount of freight would attract more steamers.

As stated in the historical summary, the London merchants opened communication with northern Russia by ships trading in the White sea in the days of Queen Elizabeth. Spurred on by the success attending this adventure to the northeast, a few years later they sent vessels to the northwest, in the hopes of opening up a similar trade, and of discovering a short and safe passage to the rich markets of China and India.

Hudson's voyage in 1610 resulted in the discovery of Hudson bay, and in the knowledge that no great opportunities existed there for extensive commerce, owing to the lack of civilized natives. James and Fox completed the exploration of the bay, without coming in contact with any of the natives residing on its shores.

The formation of the Hudson's Bay Company was due to the knowledge of the French fur traders, that a profitable trade

might be carried on with the natives frequenting the shores of the bay. This trade from its nature never required a large fleet of ships in its carrying trade, but since 1668 the company have sent annually one or more ships to supply its posts, and to bring back the valuable furs obtained from the inhabitants; and it is remarkable that with the imperfect charts of its waters so few ships have been lost in the last two hundred and fifty years; of these only a small number have met with disaster from contact with the ice in the bay or strait. From the time of the Treaty of Utrecht to the transfer of the lands of the Hudson's Bay Company to the Dominion, the bay and strait were a closed sea belonging exclusively to the Company, and other ships entered these waters unlawfully, and navigation by outsiders was practically prohibited there. The American whalers visited the northern portions of the bay as early as 1860, and within a few years their number had increased to fourteen ships wintering in its northern waters. As these vessels did not directly interfere with the fur trade they were left undisturbed, and are only mentioned here to show that other ships besides those of the Hudson's Bay Company have for a considerable period been navigating the bay, but being intent upon a paying enterprise did not herald their achievements to the public.

The Dominion Government, in 1885-86, sent out steamers under Commander Gordon to test the period of navigation of Hudson strait, and at the same time established observation stations along the length of the strait, where the action of the ice was studied during these two years. Commander Gordon reported that the strait was open for three or four months for navigation by specially constructed ships. In 1897 a second expedition was sent out under the charge of Commander Wakeham, who was accompanied by Mr. Fisher, a representative of the Manitoba government. Both reported on the navigation of the strait and bay, and practically upheld all the statements of Commander Gordon.

I was attached to the second expedition as a geologist, and performed some exploring duties on the southern coast of the strait in the late summer, having been on board the ship during her first passage through the strait. This experience in the navigation of these waters was further increased by a passage westward through the strait during the following summer in the Hudson's Bay Company's steamer *Erik,* and still further by the four trips of the past voyage.

Hudson strait has a length of nearly five hundred miles from Cape Chidley, on the south side of its eastern end, to Cape Wolstenholme on the same side of its western end. The general trend of the strait is a little north of west, so that the western cape is about a degree and a half to the northward of the eastern one, and is in 62° 30′ N. latitude. At its eastern entrance the strait has a practical channel nearly thirty-five miles wide between the outermost Button island off Cape Chidley, and the shores of Resolution island on the north side. Gray strait is a narrower channel between the Button islands and the southern mainland. Immediately to the westward of Cape Chidley the southern shore falls away to the southward to form the great bay of Ungava, which is one hundred and forty miles wide, and somewhat more than that distance in length. The large island of Akpatok lies in this bay, but as its north end is to the southward of a line drawn across the mouth of the bay, it does not seriously interfere with navigation in the strait.

From Cape Hopes Advance, the western point of Ungava bay, the southern shore of the strait has a northwest direction to Cape Weggs, situated one hundred and fifty miles beyond. The northern shore opposite has the same general trend, and the strait for this distance averages sixty miles across. Big island, situated on the north side in the western half of this portion, extends southward, so as to reduce the width to thirty miles.

To the westward of Cape Weggs the general trend of the south coast is nearly due west, while the opposite side continues northwest to form Gordon bay, after which it bends to the west and south, so that at its western end the strait is about one hundred miles from mainland to mainland, but of this distance the practical channel is limited to that portion between the south coast and the large island of Nottingham, a distance of thirty-five miles.

In the western half of the strait, Charles island, which lies about twenty-five miles beyond Cape Weggs, is the only obstruction to navigation. This island is twenty-five miles long, and lies nearly due east-and-west, some twenty miles from the south shore of the strait. The ship channel passes to the northward of the island, although there is a good channel on its south side.

The depth of water in the ship track through the strait varies from fifty to two hundred fathoms. There are no shoals, and with ordinary precautions, there is little danger from stranding on the bold shores of either side of the strait, or on the few islands that bound the channel.

A number of safe harbours easy of approach have been explored on the southern side of the strait, and others equally good and safe are known to be located on the north side, although they are at present unsurveyed.

The passage from the western entrance of the strait to the port of Churchill, on the western side of Hudson bay, is five hundred miles. From the mouth of the strait the course is due west for seventy miles to the eastern end of the wide channel between Coats and Mansfield islands. This channel is practically one hundred miles long, and varies in width from fifty miles at the eastern end, to over a hundred at the other.

The general course of the ship track from the eastern end of this channel to Churchill is nearly southwest, and there are nowhere any dangerous shoals or other obstructions to navigation.

In the track across Hudson bay the depth of water varies from fifty to two hundred fathoms, while the approach to the low shores of Coats and Mansfield and those of the western mainland is signalled by the gradual lessening of the depth of water, which gives ample warning to ships approaching the land.

It will be seen from the above description that there is no natural difficulty in the navigation of the bay and strait so far as the depth of water, presence of obstructions and width of channel are concerned, and if situated in a more southern region the route would be an ideal one for the navigator.

The western coast of Hudson bay is low and flat. It rises very slowly inland from swampy shores, while the water deepens slowly, and there are numerous shoals and bars that extend for a considerable distance from the shore-line and render coastwise navigation dangerous. This character of coast extends from the southern end of James bay to beyond the mouth of Churchill harbour. Further north the character of the coast changes somewhat, being still low, but much more uneven in outline, with a corresponding unevenness in the sea-bottom. Beyond Eskimo point, in 61° N. latitude, the straight shores of the southward give place to a ragged coast-line broken by large bays, and fringed with rocky islands having shallow water between them, and a broken bottom very dangerous to navigation. On this account, and because of the danger from outlying shoals and strong currents, the navigation of Chesterfield inlet and that of the other northern bays and harbours is debarred from consideration.

The mouths of all the large rivers to the southward of Churchill are more or less blocked by deposits of sand and clay brought down by the streams and deposited in the quieter waters at their mouths in the form of bars or flat shoals. In consequence of these obstructions, only small craft can enter the harbours inside the mouths of these rivers, and larger ships are

obliged to lay in the dangerous roadsteads usually several miles away from the nearest dry land.

The approach to the harbour of Churchill, if aided by a few beacons and lights, would be comparatively safe, as the channel of approach is fairly deep and wide. Once inside the points of the mouth, the harbour extends up stream about a mile, and has an average width of half a mile, with a couple of shallow places in the upper part that might easily be removed by dredging; the general depth of the harbour being from four to four and a half fathoms.

Some knowledge of the currents is desirable in discussing the navigability of Hudson strait and Hudson bay, for on them depend largely the character and amount of ice met with in these northern waters. Observations on the drift of the ice that covers the Arctic seas point to a general law governing the currents. This law, briefly stated, is, that no matter what the size, shape or direction of one of these northern bodies of water may be, the direction of flow of the current will be such that one facing with it will have the land on the right hand. This may be differently stated by saying that with bodies of water having a general north-and-south trend, the current will flow north on the east side and south on the west, while in east-and-west bodies the direction of flow will be west on the north side and east on the south side. This law has been found to apply to the waters of Hudson strait and Hudson bay as well as to those of the more northern bays and straits visited on the *Neptune*. The mere statement of this law is made here, as the discussion of the causes producing it, be they due to the earth's motion or wind action, is outside the province of this report.

The current from the eastward along the northern side of Hudson strait was known to the early navigators of those waters, who took advantage of it when passing through the strait from the Atlantic. The presence of icebergs in the north-

ern waters of the strait can only be accounted for by this current, for they must all come from Davis strait, there being no glaciers to produce them on the lands fronting on the strait or bay. These icebergs have been seen as far west as the western end of Salisbury island, almost to the entrance of Hudson bay.

The east-flowing current of the south side of the strait was proved by the drift of the *Neptune* when beset in the ice off Cape Wolstenholme, and later, off Cape Weggs. In the former instance the drift of the ship was thirty miles in twenty-four hours, while in the latter it was twenty miles in twenty hours. Driftwood borne north on the current of the east side of Hudson bay is not rare on the southern shores of the western part of the strait, while large quantities of it are found on the eastern shores of Ungava bay, having been drifted east and north from the mouths of the rivers emptying into the head of that bay.

The current flowing westward along the north side of the strait sweeps northward up the east side of Fox channel, rounds the head of that large northern bay, and then flows southward along the east side of Southampton, bringing with it the heavy ice from the northern parts of Fox channel, so that heavy drift ice is almost always found to the north of the eastern entrance to Evans strait, and often comes sufficiently south to partly block the channel between Mansfield and Coats islands.

The current from the north along the western shores of Hudson bay is not important as regards navigation, as it comes from the narrow waters of Roes Welcome and does not transport a large quantity of field ice.

Similar currents follow the shores of Baffin bay and Davis strait; on the east, or Greenland side, the flow is northward, while along the west side or that of the Arctic islands the current is southward, and carries on its surface great quantities of heavy field ice formed in these northern waters, together with extensive masses of Arctic ice which have passed south or east

Rafted Ice in Roes Welcome, June, 1904.

through the wide sounds connecting the northern parts of Baffin bay with the Arctic ocean. Many icebergs discharged from the northern glaciers are also found in this heavy ice of the 'middle pack' of Baffin bay and Davis strait. This Arctic current closely follows the eastern shores of Baffin island, branches of it sweeping into Cumberland gulf and Frobisher bay. When it reaches the latitude of the mouth of Hudson strait, the part adjacent to the land turns westward through the channel between Resolution island and the north shore of the strait, while another stream sweeps westward around the island of Resolution, where, meeting the current flowing out of the strait, the strong cross currents, tides and 'overfalls' noted by the earliest navigators are formed.

The main stream of the Arctic current passes southward across the mouth of Hudson strait, and forms the northern current of the Atlantic coast of Labrador. It bears on its surface the wide stream of ice which in the summer forms the 'middle pack' of Baffin bay, and which later in the year passes the mouths of Cumberland gulf and Frobisher bay, and in November, or early in December, closes the eastern entrance to Hudson strait. At that time a considerable area of this northern ice may enter the eastern part of the strait, but is prevented from completely filling the strait by the amount of locally formed ice already covering its waters. Continuing southward on the current, this stream of ice, often upwards of fifty miles in width, blocks the coast of Labrador during the early months of the year, and by the end of March arrives off the coasts of Newfoundland, bearing on its surface an immense number of newly-born seals to make the important seal fishery of Newfoundland. Part of this ice is carried through the Strait of Belle Isle into the northern portion of the Gulf of St. Lawrence, while the greater portion passes south along the east coast of Newfoundland to Cape Race. Here the western part of the ice

is deflected to the westward along the southern shores of the island, and finally enters the southern part of the Gulf of St. Lawrence, while the remainder is soon melted in the warmer waters of the Atlantic south of Newfoundland.

Ice commences to form in the smaller bays of the northern parts of Hudson bay and Hudson strait early in October, and by the end of that month the northern harbours are frozen over. The more southern ones, especially those at the mouths of the larger rivers, do not close until late in November or early in the following month. By the beginning of January, James bay is frozen across, and at the same time solid ice usually extends from the east coast of Hudson bay to the outer line of islands, some sixty or seventy miles from that coast. In other parts of Hudson bay, and in Hudson strait a margin of solid ice usually extends from one to five miles from the shore, except where the coast is high and bold with deep water close to the base of the cliffs. In such places, especially at headlands, solid ice does not form, and the natives in winter often have to make long and difficult detours inland to pass them.

The main body of Hudson bay does not freeze solid, and the same may be said of Hudson strait. Although this is the case, these waters are quite unnavigable for ordinary ships during the winter and spring months owing to the great sheets of heavy ice borne backwards and forwards by the tides and currents, and drifted about by the winter gales. There is little doubt that a specially constructed ship for ice navigation might pass through Hudson strait at any season, but the voyage would be a long one, and the difficulties and dangers would be great.

The ice of Hudson bay and the greater part of that of Hudson strait is of local origin, being formed by the freezing of the surface of the sea near-by. Observations on the growth in thickness of the ice were made in Fullerton harbour throughout the winter of 1903-04, and a record of the weekly observations is

Ice in Cumberland Gulf, September, 1904.

PUBLIC LIBRARY

given later in the report. These observations show that the thickness increases steadily until the month of June, when a maximum of seventy-four inches was measured. The conditions under which this was obtained were very favourable for the ice, and only in similarly protected northern harbours does it attain such a thickness. In the larger bays and along the unprotected coasts, where the ice freezes later, and is frequently broken up by gales during the winter, the thickness rarely exceeds three or four feet. This thinner ice makes up the greater part of that found in the spring-time covering the waters of Hudson bay and strait.

As the ice continues to increase until June, winter conditions continue well into that month, and it is not until its last days that the heat of the sun is sufficiently strong and sustained to begin the melting process. With the advent of July this process is well under way, and the daily change in the condition and amount of the ice is then marvellous, so much so, that where everything was fast frozen in the beginning of the month, by the middle not a vestige of ice remains.

If a single thickness of sheet ice covered these northern waters they would be completely clear early in July, but unfortunately much of the floating ice is 'rafted' or piled up, sheet on sheet, and the whole cemented solidly together to form large masses often twenty feet or more in thickness. This rafting is caused by the pressure formed by large masses of ice driven together, or against ice attached to the shores, which causes the ice along the margins to break and buckle, cake on cake. These pressure areas are often of considerable size, and usually are many times longer than broad. They serve as a framework to hold together large fields of single sheet ice. When the thinner ice melts, these pressure masses remain, and are dangerous to shipping until the water has become sufficiently warm to melt the ice cementing the cakes together; then they are harmless,

as the slightest shock causes the mass to fall to pieces with a great commotion but with little danger. This disintegration is known as 'calving.'

The northern ice which occasionally enters Hudson strait in the early part of the winter as before described, is much more complicated and much heavier in character than the local ice. Some of this ice may be met with in the early period of navigation to the eastward of Big island, and should be treated with respect. The icebergs included with it often remain until late in the season, and form a source of danger in foggy weather, but they are usually so few as to be negligible, especially in the western half of the strait.

To summarize the foregoing: Hudson strait and Hudson bay do not freeze solid, but are so covered with masses of floating ice as to be practically unnavigable for at least seven months in the year. The ice does not begin to melt until well into the month of June, and is not sufficiently melted for safe navigation with ordinary steamers until the middle of July. No ice is formed in the strait and bay sufficiently heavy to obstruct ordinary navigation until the latter part of November, but towards the close of this period there is danger from the early passage of the northern pack across the mouth of the strait, and also, to a much less degree, from the ice from Fox channel partly closing the western entrance to the strait.

When the temperature of the air falls several degrees below zero, as it does in November, a thick mist or fog rises from the open water and renders navigation somewhat dangerous. In the early part of the season before the ice has completely melted, fogs are liable to occur in proximity to the ice fields. At other times fogs are not prevalent, and the weather is ordinarily fair.

The worst storms come from the south and east, and these are usually accompanied by rain in the summer, and by snow later in the season. Northerly winds bring clear cold weather as a rule.

The period of safe navigation for ordinary iron steamships through Hudson strait and across Hudson bay to the port of Churchill, may be taken to extend from the 20th of July to the 1st of November. This period might be increased without much risk by a week in the beginning of the season and by perhaps two weeks at the close.

Ships entering Hudson strait from the Atlantic during the early part of the season, when ice is present in the strait, should keep in the northern half of the channel between Resolution and the Button islands. Care should be taken to keep some miles from Resolution, as the strong currents close to the island cause the ice to come together and open again with considerable violence. The north side of the strait should be followed as far as Big island, keeping at a respectful distance from the land in order to avoid the pressure when the ice is pressed on the land by southerly winds. There are frequently large quantities of ice in the neighbourhood of Big island, with at times considerable pressure; on this account ships should not approach close to the island. From Big island the course should be so laid that the ship may pass a few miles to the northward of Charles island, and from there the middle channel should be followed to pass between Nottingham island and Cape Wolstenholme. The southern side of the channel between Mansfield and Coats is usually freer of ice than the north side.

In passing eastward through Hudson strait, advantage should be taken of the favourable current on the south side, and that shore followed to Charles island, where the channel to the south of the island may be used, taking care to keep well away from the mainland until Cape Weggs is passed. The southern half of the centre channel should then be followed to beyond Big island, when the mid channel across the mouth of Ungava bay will probably be found clear of ice.

The fur trade with the Indians and Eskimos living about Hudson bay or along interior routes tributary to it, has for a

period extending over two centuries and a half furnished cargoes for two or more ships belonging to the Hudson's Bay Company. At the present time two ships are engaged in this trade for the Company, while Revillon Bros. employ two more. The whale fishery now supports two ships. These four ships represent the developed trade of the bay and strait at the present time.

The undeveloped natural resources of the regions surrounding these waters appertain to mining and fisheries, and to the forestry of the territory surrounding the rivers flowing into the southern parts of the bay. Iron ores have been found on the islands and shores of the eastern side of Hudson bay, where they cover large areas and where valuable deposits corresponding to those of the hard ores of Lake Superior will be discovered when sought for. On the western shores of the bay between Chesterfield inlet and Churchill, extensive deposits of copper-bearing rocks have been located, and there is every prospect of valuable mines being discovered in that region when the ground has been properly prospected. A valuable mica mine is being worked at a profit on the north shore of Hudson strait, and the condition and character of the rocks there point to the discovery of similar deposits on that side of the strait. Iron ores are known to occur along the west side of Ungava bay, and the rocks of the southern side of the strait in many places are favourable to the occurrence of valuable minerals. The greater part of the coastal region has only been geologically examined in a hurried manner, while large stretches are practically unknown inland.

Nothing is at present known of the fisheries of the deeper waters of the strait and bay, and the knowledge of the fisheries of these waters is confined to the coasts and rivers. In the southern part of the bay, large quantities of sea-run trout and whitefish are taken by the natives. The Arctic salmon, a fish

superior to the best Pacific salmon, is plentiful along the eastern side of the bay to the northward of James bay, as well as in the mouths of the rivers of the northern and northwest coasts, and also along both shores of the strait. Lake trout is a common fish in these northern rivers and lakes. Cod have been taken in several places along the east side of Hudson bay as far north as Cape Smith; on the western side little is known of this fish beyond the occurrence of a few in Roes Welcome, and some small specimens taken among the ice at Fullerton. A cod fishery has been carried on for a number of years at Cape Chidley, and these fish are said to be plentiful along the east side of Ungava bay, but do not appear to go farther westward through the strait from the Atlantic. Cod are reported to be abundant in some of the fiords of the south side of Frobisher bay.

The forestry of the southern rivers is outside the scope of this report, and it need only be mentioned that large areas of pulpwood and merchantable spruce occur along the banks of these streams, awaiting a suitable outlet to market by way of Hudson bay and strait.

These undeveloped resources of the north will no doubt when developed add greatly to the annual shipping of Hudson bay, but the main increase to the fleet will be due to the products of the great plains of the Northwest, now rapidly filling with robust settlers. These products of the western farms, grain, butter, and cattle, will naturally seek the shortest road to the European markets; a road not only shorter, but owing to its cool climate, capable of landing perishable products and grain in a better condition than the more southern routes.

Taking Regina as a convenient centre for these northwestern farming lands, the distance from there by way of Prince Albert to Churchill is about 800 miles, or the same distance as from Regina to Fort William on Lake Superior, and a thousand miles shorter than the distance from Regina to Montreal at the head

of sea navigation on the St. Lawrence. The distance from Churchill to Liverpool is almost the same as that from Montreal to Liverpool; consequently there is a saving in distance of a thousand miles of rail or river carriage in favour of the northern route.

The question of the storage of the grain until the season following the harvest, is at first sight a serious one, but when it is known that not twenty per cent of the grain at present reaches the seaboard before the opening of navigation of the year following that in which it is harvested, this objection practically disappears, for the grain may be as well stored on the shores of Hudson bay as in the elevators on the plains, or at Fort William. The question of storage is reduced to the length of time between the opening of navigation of Hudson strait, and the time required to transport grain from Fort William to Montreal after the opening of navigation on the great lakes, and this difference in time may be measured by days.

The country through which a railway must run to reach the port of Churchill is known to offer no serious difficulties, and although the local freights between the bay and the head of Lake Winnipeg may be small, the district traversed is equal in fertility and natural resources to much of that through which the Canadian Pacific Railway runs to the northward of the great lakes. Given a good harbour, such as that of Churchill, and an adequate number of tramp steamships, there will be no difficulty in removing from that port during the season of safe navigation all the grain and other supplies that can be drawn there by a single line of rails.

The object of this article on the navigation of Hudson strait and Hudson bay is to point out the period of safe navigation, and the advantages and drawbacks of this route to Europe; other problems of transportation and usefulness being left to those in a better position to judge and pronounce upon them.

APPENDICES

APPENDIX I.

Meteorological Observations taken on board Dominion Government Steamer 'Neptune.'

(By Messrs. C. F. King, L. E. Borden and G. B. Caldwell.)

Date.	Barometer: at Sea Level.			Thermometer			Temperature of Sea.	Direction of Wind.			Anemometer.		Clouds.			Location.	Remarks.
1903.	7.	1.	7.	Mean.	Max.	Min.		7.	1.	7.	Miles per day.	Rate p. hr.	7.	1.	7.		
Aug. 26	.....	.....	29·782	51·3	....	....	....	.....	.....	NE	.....	.....	..	..	3	Bay of Islands, Nfld.	
" 27	29·893	29·877	30·030	50·4	60·5	45	..	W	NE	NE	.. ....	.. ..	5	5	9	Strait of Belle Isle.	
" 28	30·038	30·003	29·987	48·5	55·8	....	.....	N	SSE	NW	.. ..	.....	4	1	8		
" 29	29·889	29·947	30·073	45·8	54·0	....	....	NW	NW	NW	.....	.....	1	9	8	10 m. N. Turnavik Islands.	
" 30	30·167	29·956	30·005	48·5	51·0	...	... .	NW	NW	WNW	.. ....	.....	2	5	.	C. Mugford.	
" 31	29·961	29·948	. ....	52·0	52·5	....	.....	W	....	.....	.....	.....	1	5	..	Nachvak.	
	High, 30·167.																
	Low, 29·782.																
	Average, 29·970 ...			49·4													
Sept. 1	29·945	.. ...	29 939	43·5	56·3	....	. ....	.....	.....	.....	...	. ....	5	..	..	Port Burwell ...	
" 2	29·926	.....	29·844	36·6	52·8	....	....	ESE	.....	ESE	....	....	*	..	..	Frobisher Bay ..	
" 3	29·763	.....	29 828	39·3	39·5	....	. .	SE	.....	.....	....	..	*	..	10	Cumberland Gulf	
" 4	29·799	.....	29·749	37·7	40 0	....	...	NE	.... ..	ESE	...	....	*	..	10	" ..	
" 5	29·714	.....	29·731	38·8	40·2	..	.....	E	.....	SE	...	.....	10	..	6	" ..	
" 6	29·786	.....	29·831	39·3	41·5	35·5	.....	.....	.....	.....	.....	.....	8	..	3	" ..	
" 7	29·898	.....	29·850	44·3	46·0	33·0	...	.....	.....	SW	.....	.....	3	..	8	Cyrus Field Bay.	
" 8	29·819	.....	29·928	41·0	48·0	40·0	.....	NW	.....	NW	.....	.....	5	..	3	Hall Is., Baffin.	Rain showers.
" 9	29·944	. ..	29·610	36·5	48·0	35·0	....	.....	... ...	SE	.....	.....	2	..	10	Icy Cove, Baffin.	"
" 10	29·358	.....	29·331	44·5	48·0	42·0	..	S	.....	S	....	....	8	..	5	Charles Island ..	"
" 11	....	.	29·434	41·5	48·0	38 0	.....	.....	.....	S	....	.....	..	..	9	" ..	"

"	12	29·686		29·766	37·7		36·5		NW		WSW			10	7	Eric Cove	"
"	13	29·642		29·565	37·5	39·0	34·0		S		S			5	10	Nottingham Isd.	Snow.
"	14	29·797		29·924	33·8	39·0	32·0		NW		NW			10	10	Bell Island	Fog.
"	15	30·041		30·198	32·9	37·0	27·0		NW		NW			10	10	Fisher Str.	
"	16	30·166		29·915	36·2	37·0			NW		SW			8	5	S. of C. Fullerton	Snow flurries.
"	17			29·675	41·0	43·0	36·0								10	Near Whitney Inlet.	Rain.
"	18	29·656		29·650	39·9	41·0	37·0		SW		SW			10	8	"	"
"	19	29·650		29·657	38·8	41·0	37·0		WSW		S			10	9	Winchester Inlet	
"	20	29·514		29·499	35·5	37·0	35·3		E		NE			10	10	"	Rain and snow.
"	21	29·537		29·688	36·2	37·0	35·0		N		N			10	9	"	Rain.
"	22			30·075	35·0	40·0	33·0		NE		NE			8	10	"	Snow.
"	23	30·149		30·176	36·0	40·0	30·0		SE		SE					Cape Fullerton	"
"	24	30·084		30·057	26·5	28·0	25·0		E by N		NE					"	
"	25	29·892		29·890	28·0	33·0	25·0		NE		NE					"	
"	26	29·895		29·829	27·5	33·0	25·0		NE		NE					"	
"	27	29·774		29·729	30·5	35·0	26·0		NE		NE					"	Small ponds frozen.
"	28	29·695		29·675	29·5	34·0	27·0		NNE		NNE					"	Snow.
"	29	29·685		29·430	29·0	34·0	22·0		ESE		ESE				10	"	"
"	30	29·131		29·068	34·5	39·0	30·0		S		S by W			‡	‡	"	Rain and snow.
		Average,	29·763		36·3												
		High,	30·198			56·3											
		Low,	29·068				22·0										
Oct.	1	29·136		29·368	33·5	39	32		N		WSW					N. W. Hudson Bay.	Rain and snow.
"	2	29·937		30·181	20·5	33	12		NW		NW					Chesterfield Inlet.	
"	3	30·234		29·926	23·5	29	17		NE		E					"	Snow.
"	4	29·430		29·093	32·5	33	31		ESE		NE					"	Rain and snow.
"	5	28·843		28·990	22·3				NW		NW			8		"	Snow.
"	6	29·325		29·634	22·3	34	21		W		WSW			5	8	"	
"	7	29·832		29·882	17·0	26	13		W		NW			2	3	"	Fog.
"	8	29·797		29·707	18·8	21	14		NW		N			3	8	"	
"	9	29·430		29·513	21·5	23	19·5		NNW		SW			10	4	"	Snow.
"	10	29·779		30·017	20·0	26	16		NW		NW			8	2	Outside Fullerton Harbour.	
"	11	30·333		30·444	13·5	24	13		W		N			2		Fullerton and winter quarters	
"	12	30·341		30·051	23·3	27·5	9		SE		SE			5	10	"	

* Fog. ‡ Partly.

APPENDIX I.—Meteorological Observations taken on board Dominion Government Steamer 'NEPTUNE'—*Continued.*

Date.	Barometer: at Sea Level.			Thermometer.			Temperature of Sea.	Direction of Wind.			Anemometer.		Clouds.			Location.	Remarks.
1903.	7.	1.	7.	Mean.	Max.	Min.		7.	1.	7.	Miles per day.	Rate p. hr.	7.	1.	7.		
Oct. 13	29·889	....	29·785	26·5	30·0	23	.....	N	.....	ENE	...	.....	7	..	10	Fullerton and winter quarters	
" 14	29·406	.....	29·174	30·7	32·5	23	.....	E	.....	E	.....	.....	10	..	10	" ..	Snow.
" 15	29·179	.....	29·523	16·8	24·0	5	...	NW	.....	WNW	.....	.....	10	..	..	" ..	"
" 16	29 684	...	29·924	3·0	15·0	--3·5	....	NW	.....	NW	...	.....	..	..	..	" ..	Harbour frozen over.
" 17	29·839	.....	29 765	2·5	18·0	--8·5	...	SE	.....	.....	.....	.....	5	..	..	" ..	
" 18	.....	..	29 331	1·5	18·0	--8·5	.....	.....	.....	NW	.....	.....	..	..	..	" ..	
" 19	29·340	.....	29·111	6·5	10·0	— 3	.....	NW	.....	W	.....	.....	..	..	10	" ..	Snow.
" 20	28·765	.....	29·032	11·0	14·0	9	....	WSW	.....	W	.....	.....	10	..	10	"	
" 21	29·321	...	29·590	8·5	14·0	4	.....	W	.....	.....	.....	.....	10	..	..	" ..	"
" 22	29·774	...	29·973	2·0	6·0	— 3	.....	.....	.....	W	.....	...	..	..	..	" ..	
" 23	29·971	.....	29·352	11·0	23·0	— 2	...	E	.....	SE	...	...	..	..	10	" ..	"
" 24	29·383	....	29·714	23·5	27·0	8	.....	ESE	.....	NNE	...	.....	10	..	3	" ..	"
" 25	.....	....	30 234	8·0	18·0	5·5	...	.....	.....	.....	...	.....	..	..	..	" ..	
" 26	29·941	.....	29·909	15·0	19·0	15	.....	N	.....	NE	...	.....	5	..	5	" ..	"
" 27	29·767	....	29·206	28·8	30·5	16	.....	SSE	.....	SSE	....	....	10	..	10	" ..	
" 28	28·969	...	29·213	23·7	32 0	3	....	SE	.....	NW	...	.....	..	..	..	" ..	Rain and snow.
" 29	29·638	.....	29·869	1·0	15·0	--6·5	...	NW	.....	NW	...	.....	3	..	..	" ..	
" 30	29·931	.....	29·810	3·0	7·0	1	...	NE	.....	NE	...	.....	5	..	5	" ..	
" 31	29·721	.....	29·656	16·3	25·5	6	.....	NE	.....	S	.....	.....	5	..	10	" ..	
	Average,	29·648	....	16·4													
	High,	30·444	....	.....	39·0												
	Low,	28·765	...	.....	.....	--8·5											
Nov. 1	29·704	.....	29·372	27·2	30	25	...	SW	S	SE	219	9·1	10	10	10	Fullerton.....	
" 2	.....	29·404	29·346	27·0	32	22	.....	W	W	N	380	15·8	10	5	10	"	Snow.
" 3	29·444	29·684	29·828	11·9	26	5	.....	W	NW	W	360	15·0	3	..	2		
" 4	29·957	30·094	30·220	5·5	11	— 3	.....	W	NW	NW	330	13·5	1		1		

"	5	30·156	29·980	29·689	10·1	24	— 2	....	NW	W	SSW	410	17·0	2	10	10				
"	6	29·209	29·097	29 120	26·8	30	21	.....	W	SW	SW	650	27·0	10	10	10	Fullerton	.....	"	
	7	29·255	. ...	29·350	15·6	29	6	.....	NW	.....	NE	150	6·25	10	3	..				
	8	29·448	29·554	29·627	8·0	10	— 2	.	NE	NW	NW	70	2·9	1	1	2				
	9	29·616	29·627	29·611	6·3	8	— 2	.....	NW	NW	.....	80	3·3	6	8	.				
"	10	29·654	29·721	29·715	9·3	12	5	.....	NE	NE	NE	100	4·16	10	10	10				
"	11	29·651	29·663	29·633	6·8	11	— 2	...	NE	NE	NE	770	32·08	9	9	10	"	.....	Blizzard.	
"	12	29·523	29·393	....	11	...	.....	.....	NE	NE	.....	860	47·77	10	10	..	"	.....	Anemometer out of order. Record for 18 hours.	
"	13	.....	.....	.....	20·1	24	12	.....	NE	NE	NE	.....	.....	10	10	8				
"	14	29·528	29·680	.....	14·3	25	12	.....	NE	NE	NE	.. ..	.....	7	10	10				
"	15	30·156	30·220	30·247	—4·1	8	—15	... .	... .	.....	.....	.....	.....	..	..	.	"	.....	Aurora. Snow.	
"	16	30·044	29·977	29·909	—8·3	5	—16	.. .	.....	W	NW	295	32·77	..	3	..	"	.....	Anemometer reading for 3 hours. 13 in. ice in harbour.	
"	17	29·730	29·728	29·756	—1·8	2	— 8	.....	N	N	NW	75	3·12	..	2	..				
"	18	29·727	29·656	29·668	—13·1	4	—18	.....	N	NW	N	90	3·75	1	..	..	"	.....	Aurora.	
"	19	29·647	29·669	29·727	—12·8	— 8	—18	.....	W	N	.. ...	90	3·75	3	..	.	"	.....	"	
"	20	29·785	29·861	29·928	—3·1	— 1	— 20	.....	NE	N	.....	100	4·17	8	8	8				
"	21	29·988	30·072	30·122	—2·0	3	— 8	.. .	N	N	.....	120	5·0	10	10	..	"	.... ..	Snow. Aurora.	
"	22	30·124	30·070	30·076	—15	— 4	—20	.....	NW	NW	NW	100	4·17	9	1	..				
"	23	29·942	29·025	30·025	—9·5	— 8	—20	.....	.....	.....	NW	105	4·37	5	2	..				
"	24	30·206	30·340	30·465	—1·3	— 1	12	... .	NE	NE	NE	155	6·46	10	10	10				
"	25	30·542	30·563	30·020	4·5	11	— 4	.....	NE	S	SE	230	9·58	10	8	5				
"	26	30·187	30·127	29·907	1·6	11	— 9	.....	NE	E	E	210	8·75	..	6	10				
"	27	29·734	29·772	29·869	14·3	15	0	.....	S	SE	S	560	23·3	7	10	10				
"	28	30·100	30·281	30·392	15·3	19	12	. .	E	S	E	205	8·54	10	10	10				
"	29	30·422	30·376	30·338	6·1	11	0	.....	N	N	N	75	3·13	9	3	9				
"	30	30·073	29·975	29·907	—6·3	11	—10	.	N	NW	W	230	9·58	..	..	..	"	.....	21" ice in harbour.	
		Highest, 30·563 ...				32	—20					Gr'atest, 190 miles in 3 hours.	Average, 6·33							
		Lowest, 29·120...				....														
		Average, 29·609....			4 8															
Dec.	1	29·746	29·638	29·616	—8·6	— 6	—12	.....	NW	NW	NW	130	5·41	..	2	..	Fullerton	.....	Aurora.	
"	2	29·578	29·724	29·727	4·	9	—11	... ..	NW	SE	NE	60	2·5	4	10	10	.....	.....	Snow.	
"	3	30·124	30·750	30·261	—19·6	7	—24	....	N	N	NW	220	9·1	1	..	..	.....			
"	4	30·273	30·009	29·850	— 5·8	3	—25	...	W	SW	E	260	10·25	5	10	8	.....	.. ...	Aurora.	
"	5	29·539	29·560	29·735	—7·3	5	—25	....	N	N	N	330	13·75	3	10	..	.....	..		
"	6	29·806	29·734	29·720	—26·0	15	—29	....	N	NW	N	415	17·29	..	..	..	... .	.....		
"	7	29·578	29·562	29·593	—18·3	—15	—26	.....	N	N	NW	435	18·12	..	2	1	.....		24" ice in harbour.	

APPENDIX I.—Meteorological Observations taken on Board Dominion Government Steamer 'NEPTUNE'—*Continued.*

Date.	Barometer at Sea Level.			Thermometer			Temperature of Sea.	Direction of Wind.			Anemometer.		Clouds.			Location	Remarks.
1903.	7.	1.	7.	Mean.	Max.	Min.		7.	1.	7.	Miles. per day.	Rate p. hr.	7.	1.	7.		
Dec. 8	29·477	29·559	29·653	—13·6	—11	—20	.....	NW	NNW	NW	230	9·58	..	..	..	Fullerton.	Aurora.
" 9	29·750	29·742	29·660	—20·6	—15	—25	.....	NW	WNW	WNW	100	4·17	1	..	..	.....	
" 10	29·586	29·594	29·585	—17·6	—15	—26	.....	N	NW	.....	135	5·62	3	1	..	.....	
" 11	29·641	29·613	29·480	—8·5	2	—22	.....	N	NE	WNW	215	9·	..	6	..	.....	Snow.
" 12	29·329	29·112	29·256	13·	15	—5	.....	NNE	N	N	610	25·4	10	4	10	.....	
" 13	29·366	29·492	29·542	11·	15	7	...	N	NE	N	610	25·4	8	10	10	.....	
" 14	29·698	29·743	29·858	2·	10	—2	.....	N	NE	N	360	15·	10	8	10	.....	
" 15	29·875	29·857	29·933	—3·5	8	9	.....	.....	NW	NW	185	7·71	10	5	10	.....	
" 16	29·916	29·929	29·951	—1 7	5	—6	.....	NW	NW	NW	165	6·87	8	10	..	.....	
" 17	29·930	29·937	29·935	—0·1	2	6	.....	NW	N	NE	110	4·58	10	10	8	.....	Snow.
" 18	29·812	29·708	29·537	9·4	15	0	.....	NE	NE	NE	550	22·9	10	9	10	.....	
" 19	29·532	29·562	29·525	8·3	11	0	.....	NE	SE	E	350	14·58	..	2	10	.....	
" 20	29·429	29·498	29·579	3·8	12	— 2	.....	NE	NE	NE	510	21·25	9	5	10	.....	Aurora.
" 21	29·448	29·382	29·350	—1·8	2	—5	.....	N	N	NE	170	7·09	5	3	3	.....	
" 22	29 334	29 306	29·314	—4	0	—6	.....	N	NNW	N	300	12·50	6	10	..	.....	
" 23	29 346	29 418	29·414	—15·4	3	20	....	N	NW	.....	90	3·77	2	..	..	.....	Aurora.
" 24	29·530	29·609	29·654	17	—8	—20	.....	.....	N	.....	120	5·	2	1	10	.....	
" 25	.....	29·588	29·611	—5·2	—5	—10	.....	.....	.....	.....	200	8·35	..	10	..	.....	
" 26	29·681	29·638	29·621	—1·4	3	— 6	...	.....	.....	.....	280	11·6	3	2	..	.....	
" 27	29·619	29·603	29·602	—12·7	3	—21	.....	.....	.....	NW	80	3·33	2	3	..	.....	
" 28	29 575	29·600	29·715	—19·3	—16	—22	...	W	W	W	150	6·25	..	..	..	.....	31" ice in harbour.
" 29	.. ...	29·630	29·548	23·3	—19	—27	.. ...	W	W	W	250	10·41	..	3	..	.....	
" 30	29·288	29·194	29·232	—31·7	—21	—38	... ..	W	.....	N	140	5 83	1	..	..	.....	
" 31	29·382	29·505	29·625	—20·8	—15	—37	.....	N	N	N	490	20 41	3	..	..	.....	
	Average, 29·634....			—8·1													
	High, 30·750..				H.	L.											
	Low, 29·112....			... .	15	—38											

Jan.	1	29·827	29·849	29·915	—23·3	—19	—25	....	.....	W	.....	220	9·16	..	2	1	Fullerton.	Aurora.
"	2	30·068	30·115	30·207	—27·	—23	—33	.....	N	.....	.....	70	2·9	..	..	..	....	
"	3	30·214	30·110	29 964	—22·4	- 10	—35	.....	.....	.....	ESE	140	5·83	..	..	10	....	
"	4	29·550	29·634	29·463	—6·1	- 2	—9	.. .	SE	SE	E	330	13·75	..	10	4	... .	33″ ice in harbour.
"	5	29·716	29·777	29·889	—22·8	—8	—30	.....	N	W	W	205	8·5	..	..	..	... ...	Aurora.
"	6	29·571	29·456	29·381	—10·7	—3	—32	.. ..	E	SE	S	135	5·62	10	10	..	....	
"	7	29·457	29·654	29·714	—16·7	—4	—30	.....	NE	NE	.....	505	2·10	..	..	..	.. ..	
"	8	29·829	.....	29·845	—16·1	—10	—26	.....	.....	.....	.....	30	1·25	..	..	..	... ...	
"	9	29·860	29·841	29·881	—0·5	3	—12	.....	SE	SE	SE	285	11·87	10	..	10	.....	Haze. Aurora.
"	10	29·900	29·917	29·786	—1·2	3	—2	....	E	NE	E	480	20·	5	10	..	. . ..	
"	11	29·533	29·500	29·453	9·1	12	—1	.....	E	E	E	470	19·6	10	10	10	.....	38″ ice in harbour.
"	12	29·411	29·446	29·534	—6·1	11	—19	.....	.....	.....	NW	130	5·4	1	..	..	.....	Sun dogs 10 a.m., Aurora.
"	13	29·757	29 833	29·899	—25·4	—5	—30	.. .	NW	W	W	450	18·7	..	..	..	... ...	Aurora.
"	14	29·950	29·949	29·990	—30·1	—28	—34	.. .	W	W	W	310	12·9	..	..	..	....	"
"	15	30·014	30·042	30·088	—29·7	—26	—33	....	W	.....	.....	60	2·5	..	..	..	.....	"
"	16	30·172	30·191	30·243	—35·4	—26	—40	.....	NW	NW	NW	230	9·58	..	..	..	.....	"
"	17	30·284	30·367	30·294	—35·4	—32	—41	.....	W	WSW	WSW	420	17·5	..	..	..	.....	"
"	18	30·278	30·214	30·070	—25·4	—16	—41	.....	W	NW	SW	250	10·4	4	5	..	....	39½″ ice in harbour.
"	19	30·644	30·672	30·869	—26·3	—13	38	.. .	E	N	NE	410	17·08	..	..	..	.....	Aurora.
"	20	30·390	30·115	30·152	—39·5	—38	—42	....	NE	W	SW	70	2·92	..	..	..	....	Snow.
"	21	29·961	29·887	29·844	—16·	—12	—38	.....	S	S	E	390	16·92	5	10	10	....	Aurora.
"	22	29·890	30·014	30·087	—14·8	- 11	18	.....	E	NNE	NE	380	15·85	6	9	8	....	"
"	23	30·255	30·267	30·272	- 25·5	—20	—29	...	N	NE	NE	360	15·00	..	..	..	....	"
"	24	30·237	30·215	30·166	—29·7	—26	—33	.....	N	.....	.....	100	4·17	..	..	..	....	"
"	25	29·990	29·948	29·931	—26·5	- 23	—34	.....	.....	W	W	80	3·33	..	..	..	....	41″ ice in harbour.
"	26	29·826	29·831	29·909	—30·1	—19	34	.. .	W	W	NW	30	1·25	2	..	..	.....	Aurora.
"	27	29·996	29·942	29·861	—34·4	—28	—39	.....	.....	.....	W	40	1·66	..	..	..	....	
"	28	29·520	29·538	29·572	—22·4	- 22	—38	.....	.....	W	W	160	6·66	..	10	..	....	Snow.
"	29	29·595	29·536	29·497	—29·	—26	—34	....	W	W	W	265	11·46	..	3	..	....	Aurora.
"	30	29 492	29·500	29·545	—33·7	—25	—40	.. ..	N	.....	N	135	5·62	..	..	..	....	"
"	31	29·568	29·551	29·554	33·4	—28	40	....	.....	.....	.....	80	3·33	3	..	1	....	
		Average,	29·906....		23·0	—12	—42											
		High,	30·869....															
		Low,	29·361....															
Feb.	1	29·409	29·470	29·444	—35·7	—33	—42	.....	NE	N	N	150	6·25	3	..		Fullerton. ...	45″ ice in harbour.
"	2	29·451	29·486	29·492	—32·7	—26	—43	...	NNE	.....	... ...	130	5·41	6	..	..	.. ..	
"	3	29·494	29·515	29·565	—37·5	—35	42	.....	NNE	NNE	N	70	2·91	..	..	7	....	
"	4	29·691	29·032	29·165	—11·8	1	—38	.....	WNW	NW	N	460	19·17	10	..	..	.....	Aurora.
"	5	29·700	29·912	30·110	—23·	—10	—30	.. ...	NE	NE	N	400	16·6	..	..	..	....	"

APPENDIX I.—Meteorological Observations taken on board Dominion Government Steamer 'NEPTUNE'—*Continued.*

Date.	Barometer: at Sea Level.			Thermometer.			Temperature of Sea.	Direction of Wind.			Anemometer.		Clouds.			Location.	Remarks.
1904.	7.	1.	7.	Mean.	Max.	Min.		7.	1.	7.	Miles per day.	Rate p. hr.	7.	1.	7.		
Feb. 6	30·254	30·186	30·076	13·	1	-32	...	W	W	N	170	7·08	5	7	10	Fullerton.	Snow.
" 7	30·105	30·211	30·255	1·3	7	—4	.....	N	N	NE	440	18 33	8	3	..	.....	Aurora.
" 8	30·389	30·447	30·529	—3·4	6	—9	...	NE	NE	.....	110	4·58	1	..	..	.....	48″ ice in harbour. Aurora.
" 9	30·618	30·650	30·678	—12·7	2	—18	.....	NW	NW	W	30	1·25	1	1	..	.....	62″ ice on fresh water ponds. Au.
" 10	30·516	30·450	30·421	19 4	17	—25	.....	W	W	W	320	13·33	..	4	10	.....	Aurora.
" 11	.. ..	30·322	30·343	—23·3	—17	—31	...	.....	W	W	270	15·41	..	..	..	.....	"
" 12	30·242	30·162	30·091	—25·7	—22	—33	....	W	.....	NE	200	8·33	10	8	..	.....	"
" 13	30·027	30·074	30·141	—29·3	—22	—32	....	N	NE	.....	210	8·75	..	..	..	.....	"
" 14	30·156	30·141	30·102	—34·4	—22	—37	.....	N	N	.....	120	5·	..	..	..	.....	"
" 15	29·991	29·942	29·957	33·7	—30	-39	.....	W	W	W	90	3·75	..	..	4	.....	50″ ice in harbour.
" 16	30·118	30·313	30·408	—30·5	—26	—38	...	W	NE	.....	50	2·08	..	..	..	.....	Aurora.
" 17	30·367	30·251	30·077	—15·8	10	-37	...	E	E	SSE	210	8·75	9	10	9	.....	Snow.
" 18	29·880	29·944	30·089	22·1	—12	—36	.....	NE	N	N	220	9·17	1	..	..	.....	Aurora.
" 19	30·185	30.240	30·232	38·1	—29	—46	..	WNW	WNW	NW	510	21·41	..	..	..	.....	"
" 20	30·243	30·271	30·249	—34·4	—30	—44	....	W	W	W	370	15·41	..	..	..	.....	"
" 21	30·710	30·136	30·021	—35·5	—27	—39	.....	W	W	W	230	9·58	..	..	..	.....	
" 22	29 647	29·523	29 415	29·5	—24	35	...	W	W	W	240	10·	8	..	..	.....	53″ ice in harbour.
" 23	29·298	29·305	29·223	—32·9	—26	—37	.....	W	W	W	270	11·25	1	1	..	.....	
. 24	.....	29·313	29·446	—30·3	—22	—42	.....	.....	NW	NW	460	19·17	..	..	..	.....	Aurora.
" 25	29·457	29·556	29·649	—40·7	—38	—46	.....	NW	W	W	260	10·83	..	1	..	.....	"
" 26	29·593	29·540	29·512	—37·5	—26	—46	.....	.....	.....	.....	70	2·91	..	3	..	.....	
" 27	29·520	29·564	29·687	—37·5	—33	—43	.....	.....	W	NW	110	4·58	1	..	..	.....	
" 28	29·934	29·992	30·005	39·1	-35	-42	.....	W	W	NW	140	5·83	..	..	4	.....	55″ ice in harbour.
" 29	30·004	29·978	29·946	—39·	—36	—45	....	W	W	.....	100	4·17	..	..	..	.....	
	Average, 29·932. ..			—27·0													

	High,	30·710....			7	46													
	Low,	29·032 ..																	
March 1	29·793	29·680	29·658	—38·4	—30	—46	.....	.....	NE	NE	80	3·3	..	..	..	Fullerton.			
" 2	29·691	29·700	29.710	—46·5	—40	52	.....	W	W	W	210	8·75	..	..	..	.....	....	Mercury frozen at —50°	
" 3	29·725	29·642	29·681	—40·	—32	—53	....	W	W	W	650	27·85	..	..	..	.....			
" 4	29·738	29·718	29·730	—35·	30	40	....	W	W	W	345	14·95	..	..	..	.. ..	.....	Aurora.	
" 5	29·828	29·966	29·953	—33·	—26	—41	.. ..	W	W	W	185	7·7	..	..	..	...	.....		
" 6	30·115	30·135	30·124	—7·4	1	—32	.....	E	E	SE	190	7 9	10	10	10	.....			
" 7	30·080	30·099	30·015	0·	5	3	...	SE	SE	NE	210	8·65	10	10	10	....		58″ ice in harbour.	
" 8	30·062	30·210	30·324	—27·1	—2	—34	...	NE	N	N	440	18·35	..	..	..	.....			
" 9	30 432	30 557	30 606	26·4	—13	38	.....	W	W	W	100	4·18	..	..	..	.....		Aurora.	
" 10	30·758	30·767	30·804	24·5	13	35	.	W	W	....	30	1·25	..	..	..	.....		"	
" 11	30·733	30·825	30·835	—18·	—4	—32	.....	W	.....	.....	10	·42	..	..	1	....		"	
" 12	30·777	30·760	30·738	—9·8	—3	—23	.	.. ..	.....	.....	0	0	..	..	10	.....			
" 13	30·630	30·614	30·628	—10·7	1	19	.....	.....	W	.....	15	·625	4	6	..	.....		62″ ice in harbour.	
" 14	30·655	30·583	30·613	—12·8	—2	—25	....	W	.....	.....	5	·28	..	..	..	....			
" 15	30·444	30·381	30·312	—12·4	—9	—17	.....	.....	SW	SW	45	1·8	..	4	4	.....			
" 16	30·071	30·101	30·177	8·8	—1	—19	.	.....	NE	NNE	105	4·37	8	..	..	.....			
" 17	30·142	....	30·010	—15·8	1	—26	...	NNE	.....	W	50	2·08	..	..	1	.....			
" 18	29·824	29·760	29·752	—22·	—10	—33	.....	W	.....	W	45	1·8	..	..	..	.....			
" 19	29·614	29·564	29·648	—26 3	—15	—34	.....	W	W	W	235	9·8	5	3	..	.....			
" 20	29·688	29·821	30·002	—28 6	—23	—38	. ..	W	NW	W	350	15·	..	..	..	.....			
" 21	30·224	30·240	30·282	—19·6	—8	36	.....	.....	N	NE	120	5·	..	..	2	.....		64″ ice in harbour.	
" 22	30·008	29·910	29·857	—2·8	4	—20	.....	N	NE	NE	200	8·36	..	7	..	.....			
" 23	29·807	29·847	29·907	—8·7	—2	—16	....	NE	NE	.....	250	9·17	..	..	3	.. ..	..		
" 24	30·049	30·200	30·330	—26·8	—11	—34	....	NE	NW	NW	200	8·36	..	..	1	.....			
" 25	30·146	30·041	30·031	—29·6	—20	—40	.....	SW	NE	NW	150	6·25	10	..	..	.....			
" 26	29·882	29·822	29·771	26·7	—17	—41	. ..	NW	NW	W	200	8·36	..	..	3	.....		Aurora.	
" 27	29·369	29·208	29·176	—18·4	10	—41	.....	E	SE	NW	245	10·2	8	5	3	.....			
" 28	29·527	29·361	29·505	— 21 7	14	29	.....	W	W	W	145	6·4	..	..	2	....		68″ ice in harbour.	
" 29	29·646	29·668	29·731	26·6	—15	—37	. ..	W	W	E	80	3·3	..	..	2	....			
" 30	29·770	29·772	29·831	—9·3	2	—32	.....	E	E	E	110	4·5	8	8	10	....			
" 31	29·716	29·824	30·120	—7·3	1	—16	... .	NE	E	N	330	13·5	10	..	..	....			
	Average,	30·036....		—20·6															
	High,	30·835....			5														
	Low,	29·176....				—53													
April 1	30·474	30·469	30·361	—14·6	— 2	—30	....	W	W	SW	30	1·25	..	..	6	Fullerton.			
" 2	30·102	29·968	29·556	4·0	8	— 9	....	SW	S	SE	290	12·00	9	9	10				
" 3	29·354	29·262	29·096	14	18	7	. ...	....	E	NW	150	6·25	..	10	10				

APPENDIX I.—Meteorological Observations taken on board Dominion Government Steamer 'NEPTUNE'—*Continued.*

Date.	Barometer; at Sea Level.			Thermometer.			Temperature of Sea.	Direction of Wind.			Anemometer.		Clouds.			Location.	Remarks.
1904.	7.	1.	7.	Mean.	Max.	Min.		7.	1.	7.	Miles per day.	Rate per hour.	7.	1.	7.		
April 4	29·602	29·781	29·963	—13	18	—18	.....	NW	NW	NW	665	27·7	..	..	..	Fullerton.	70″ ice in harbour.
" 5	30·170	30·227	30·219	—10	2	—18	.....	W	W	W	290	12·9	..	..	..	.....	Aurora.
" 6	30·267	30·387	30·244	— 1·7	9	—10	.....	.....	.....	.....	20	0·83	..	..	5		
" 7	30·115	30·169	30 177	1·3	11	— 8	....	W	W	W	130	5·42	10	..	..	....	"
" 8	30·227	30·252	30·244	3	16	—11	.....	W	.....	E	208	8·66	8	4	9		
" 9	30·329	30·166	30·154	4	7	— 2	.....	NE	E	E	307	12·8	10	10	10		
" 10	30·141	30·131	30·223	— 2	5	— 5	....	E	NE	NE	388	16·2	5	2	1		
" 11	30·223	30 194	30·261	3·3	12	— 9	.....	.....	NE	.....	144	6·0	10	3	..	.....	71″ ice in harbour.
" 12	30·275	30·307	30·352	5·3	19·5	—20	.....	N	.....	NW	69	2·9	..	..	..		
" 13	30·296	30·287	30·331	8·3	26	11	.....	NW	.....	.....	6	0·25	..	..	..		
" 14	30·375	30·342	30 363	7·6	25	— 9	.....	W	W	NW	128	5·33	..	1	..		
" 15	30·100	29·897	29·526	8·3	14	— 2	.	W	W	SW	281	11·7	10	10	10		
" 16	29·355	29·462	29·603	11·0	16	4	.....	N	N	N	280	11·66	10	10	1		
" 17	29·723	29·847	30·186	5·6	12	— 9	.....	N	N	N	299	12·46	3	5	..		
" 18	30·232	30·121	30·129	8·3	21	—10	.....	N	N	NW	123	5·21	6	5	5	....	73″ ice in harbour.
" 19	29·952	29·935	29·742	10·3	17	—10	.....	W	SW	W	237	9·87	5	9	..		
" 20	29·914	30·031	30·149	5·0	12	— 2	.....	NE	NE	NE	290	12·09	..	..	..		
" 21	30·198	30·123	30·002	7·3	13	—11	.....	NE	E	SE	238	9·87	2	9	10		
" 22	29·948	30·027	30·070	11·6	16	5	....	NE	NE	NE	312	13·0	10	10	6		
" 23	30·244	30·312	30·364	8·6	19	9	....	.....	NE	.....	90	3·75	..	..	..		
" 24	30·316	30·112	29·915	12·0	18	—13	....	W	SW	SW	260	10·8	10	10	10		
" 25	30·166	30·202	30·172	13·6	19	2	....	NE	NE	E	230	9·58	..	9	10	....	74″ ice in harbour.
" 26	30·112	30·058	30·056	17·6	20	11	.....	NE	E	E	400	16·6	10	10	10		
" 27	29·811	29·596	29·534	20·3	28	15	.....	SE	SE	.....	450	18·75	10	10	..		
" 28	29·444	29·496	29·712	23·6	30	19	.....	W	W	W	380	15·8	10	9	1	....	Ptarmigan first seen.
" 29	30·078	30·128	30·143	15·0	20	....	....	NE	E	E	248	10·3	6	10	10		
" 30	29·941	29·778	29·650	25·6	31	13	.....	E	SE	SE	510	21·25	4	10	10		

	Average,	30·101		7·17														
	High,	30·474			31													
	Low,	29·096				−30												
May 1	29·940	30·017	30·077	22·6	30	8		NW	NW	NW	283	11·8	1	3	10	Fullerton.		
" 2	30·081	30·015	30·066	21·6	30	14		SW	W	W	385	16·0	10	10				74″ ice in harbour.
" 3	30·149	30·176	30·143	7·3	15	− 3		NW	NW	NW	427	17·8						
" 4	30·164	30·219	30·226	12·6	20	− 7			NW	W	255	10·62			10			
" 5	30·177	30·177	30·117	21·6	31	9		NW		NE	202	8·42	9	10	10			
" 6	29·965	29·825	29·632	18·0	20	14		NE	NE	NE	386	16·08	10	10	10			Solar corona, 4.30 p.m.
" 7	29·444	29·479	29·552	20·6	23	16		NE	NE	N	654	27·25	10	10	10			
" 8	29·626	29·630	29·656	11·5	19	10		N	N	NW	660	27·5	10	10	10			70½″ ice in harbour.
" 9	29·577	29·548	29·558	14·0	19	9		NW	W	NW	480	20 0	10	10	10			
" 10	29·813	29·974	30·121	11·0	15	0		W	W	W	745	31·04		9	10			
" 11	30·226	30·276	30·226	13·0	15	7		W		W	305	12·7	10	10	10			
" 12	30·149	30·106	30·050	18·3	28	14		W	W	W	236	9 83	10	2	5			
" 13	30·103	30·005	29·946	12·6	19	4		W	W	W	264	11·0	9	8				
" 14	29·867	29·838	29·890	13·0	22	− 2			W	W	130	5·4			10			
" 15	30·020	30·045	30·154	26·3	37	5				N	50	2·08			10			
" 16	30·296	30·347	30·378	18·3	24	3		NE	E	E	140	5·83		1	10			71½″ ice in harbour.
" 17	30·277	30·130	29·978	23·6	27	9		E	E	SE	510	21·25	10	10	10			
" 18	29·891	29·832	29·895	27·3	34	22		S	SW	W	370	15·41	10	3	2			
" 19	30·062	30·164	30·126	31·3	40	14			E	NE	165	6·87	10	10	10			Gulls, geese and shore larks first seen.
" 20	30·145	30·067	29·973	24·3	31	16		E		SW	155	6·45	10	10	10			Hawk first seen.
" 21	29·686	29·546	29·410	30·3	32	25		SW	SW	SW	270	11·25	10	10	10			
" 22	29·076	28·925	28·942	31·3	33	29		S	S	W	370	15·41			10			
" 23	28·994	29·105	29·123	29·2	38	23		SW	NE	N	360	15·0		10	5			75 in. ice in harbour.
" 24	29·184	29·143	29·141	19·3	23	11·5		NW	NW	W	650	27·1		6	10			
" 25	29·182	29·252	29·370	20·2	22	17		SW	SW	SW	400	16·6		10	10			
" 26	29·412	29·459	29 514	23·3	24	15			S	SW	150	6·25	10	10	10			
" 27		29·523	29·568	27·2	32	22		S	E		150	6·25	10	10	10			
" 28	29·532	29·543	29·569	28·3	31	15		NE	E	NE	320	13·3	10	10	10			
" 29	29·658	29·688	29·718	31·6	38	23				W	32	1·33	9	4	2			Fresh water, pools open.
" 30	29·765	29·822	29·775	29·0	31	16			E	E	88	3·66	10	10	10			72 in. ice in harbour.
" 31	29·815	29·836	29·848	30·3	35	22			SE	E	90	3·75	9	10	10			Snow geese seen.
Average,	29·802		21·6															
High,	30 378			40														
Low,	28·925				− 7													

APPENDIX I.—Meteorological Observations taken on board Dominion Government Steamer 'NEPTUNE'—*Continued.*

Date.	Barometer: at Sea Level.			Thermometer.			Temperature of Sea.	Direction of Wind.			Anemometer.		Clouds.			Location.	Remarks.
1904.	7.	1.	7.	Mean.	Max.	Min.		7.	1.	7.	Miles per day.	Rate per hour.	7.	1.	7.		
June 1	29·740	29·673	29·676	28·6	34	24	29·2	NE	NNE	N	340	14·17	10	10	10	Fullerton	Snow.
" 2	29·838	29·911	29·978	35·6	44	29	29.6	NNW	N	.....	225	9·37	7	5	5	.....	
" 3	30·110	30·137	30·433	32·5	37	29	29·7	NNE	NE	NE	125	5·21	10	10	9	.....	
" 4	30·273	30·525	30·377	33·3	38	21	29·9	E	.....	SE	60	2·5	10	1	8	.....	Snow.
" 5	29·992	29·968	29·883	29·3	47	25	29·9	S	S	.....	370	15·42	10	10	10	.....	
" 6	29·994	.....	30·070	35·2	47	25	29·	NE	.....	.....	25	1·04	9	5	2	.....	70″ ice in harbour.
" 7	29·820	29·780	29·473	29·8	33	20	29·3	SE	S	S	405	16·9	10	10	10	.....	Rain. Fog.
" 8	29·707	29·839	29·962	37·5	38	31	29·8	N	N	SW	395	15·62	..	5	4	.....	Snow.
" 9	30·176	30·212	30·186	34·8	37	28	.....	SW	S	S	250	10·4	3	9	9	.....	"
" 10	30·100	30·176	30·213	35·	42	28	29·5	S	E	E	285	11·9	5	..	4	.....	
" 11	30·164	30·110	30·045	33·6	46	29	29·7	E	E	E	520	21·66	10	10	10	.....	Rain.
" 12	29·938	29·952	29·921	32·	36	29	29·5	NE	NE	.....	735	30·62	4	10	10	.....	"
" 13	29·712	29·631	29·606	30·3	32	27	29·5	NNE	NE	NE	695	28·96	10	10	10	.....	66″ in harbour.
" 14	29·590	29·556	29·621	30·	37	28	29·	NNE	NNE	N	340	16·1	10	8	6	.....	Anemometer reading for 21 hours. Sleet.
" 15	29·729	29·752	29·810	34·2	38	28	29·5	N	N	NNE	225	9·37	5	4	6	.....	
" 16	29·845	29·912	30·211	36·6	42	28	29·	N	N	.....	105	4·37	4	..	10	.....	
" 17	30·081	30·095	30·089	35·6	46	29	29·5	SW	SW	SSW	50	2·09	10	8	..	.....	Rain and Sleet.
" 18	30·614	29·868	29·810	31·	35	27	29·5	S	S	S	245	10 21	10	10	10	.....	
" 19	29·713	29·704	29·666	36·3	49	32	29·5	SW	SW	NW	325	13·54	7	5	4	.....	58″ ice in harbour.
" 20	29·679	29·678	29·729	49·3	60	30	30·	W	W	NW	350	14·6	4	3	3	.....	
" 21	29·753	29·753	29·746	54·3	63	34	30·	W	W	W	100	4·16	4	6	4	.....	Rain.
" 22	29·724	29·616	29·725	43·6	46	32	29·5	.....	.....	NW	205	8·54	10	..	8	.....	
" 23	29·729	29·750	29·837	42·3	50	31	30·	NNE	NNE	E	275	11·46	3	3	3	.....	

"	24	30·219	30·419	30·438	40·	48	29	30·	E	E	SE	85	3·54	6	6	9	Fullerton.	
"	25	29·897	....	29 810	37·5	41	33	29 5	.....	.....	SSE	115	4·8	6	..	10	... ...	Fog. (high). Rain.
"	26	29·793	29·720	29·715	41·	48	33	31·	W	W	NW	100	4·16	4	9	3	.....	
"	27	29·669	29·619	29·698	43·3	47	34	30·5	NE	NE	N	165	6·9	3	2	5	. .....	45" ice in harbour.
"	28	29·723	29·619	29·637	42·6	44	36	30·	NW	N	N	185	7·7	8	8	3	..... .	
"	29	29·679	....	29·915	42·5	43	36	30·	N	...	N	130	5·4	2	..	3	....	
"	30	29·936	29·957	30·021	44·5	49	33	31·	W	NW	W	170	7·8	..	..	..	....	
		Average,	29·894....		37·4													
		High,	30·614....			63												
		Low,	29·473....			20												
July	1	30·015	29·866	29·965	45·	48	33	31·5	W	W	W	160	6·6	1	1	3	Fullerton.	
"	2	30·522	30·506	30·453	46·3	51	32	30·5	S	SW	W	80	3·3	2	1	4	"	
"	3	30·013	30·029	30·448	44·6	57	34	31·	E	E	.....	90	3·75	1	3	..	"	
"	4	29·926	29·821	29·671	46·6	52	34	31·	.....	NW	NE	140	5·83	5	6	3	"	22" to 45" ice in harbour. Mirage.
"	5	29·678	29·684	29·718	43·3	51	38	31·	NE	E	.....	165	6·87	3	4	3	"	
"	6	29·758	29·774	29·740	40·	47	33	31·	E	E	E	160	4·16	4	5	5	"	Rain.
"	7	29·768	29·772	29·710	33·	38	32	31·	E	SE	S	205	8·54	9	10	10	"	"
"	8	29·713	29·769	29·597	35·6	37	32	31·5	SE	SE	SE	190	7·9	10	10	10	"	Fog.
"	9	29·417	29·309	29·322	42·	43	34	32·	NE	NE	NE	160	6·6	10	9	10	" . ..	Rain.
"	10	29·211	29·152	29 197	42·6	46	36	31·	NE	N	NE	160	6·6	10	10	10	"	"
"	11	29·220	29·727	29·341	37·	41	35	31·5	E	....	.....	180	7·5	10	10	10	" ...	30" ice in harbour. Rain.
"	12	.....	29·561	29·867	41·5	47	33	31·	N	.....	E	300	12·5	5	..	10	"	Showers.
"	13	29·492	29·504	29·447	40·3	42	31	31·	E	E	E	230	9·5	10	10	10	" ...	
"	14	29·406	29·467	29·512	39·	43	33	32·	E	E	NE	.....	...	9	4	3	" ...	
"	15	29·514	.....	29·543	39·	42	33	32·	S	SW	S	.....	...	9	5	6	"	
"	16	29·629	29·717	29·745	41·	46	34	31·5	SW	SW	.....	.....	.....	4	..	4	"	
"	17	29·814	29·803	29·779	48·	50	31	32·	.....	.....	.....	.....	.....	2	..	2	"	
"	18	29·733	29·715	29·686	47·	52	34	35·	NNW	.....	N	.....	.....	2	2	2	Southampton I. .	
"	19	29·615	29·528	29·630	44·6	47	35	34·	NNE	NNE	N	.....	.....	3		3	Fisher strait. . .	
"	20	29·679	29·566	29·422	39·	43	34	30·5	N	N	.....	.....	.....	6	3	..	Digges island . . .	In ice.
"	21	29·393	29·467	29·570	34·5	38	31	32·	.....	WSW	SW	.....	...	10	10	10	" ..	"
"	22	29·480	29·480	29·445	41·6	54	37	..	W	SW	S	.....	.....	5	3	10	....	"
"	23	29·414	29·478	29·441	39·	46	34	.....	S	NW	NW	.	.....	9	6	4	....	Showers.
"	24	29·655	29·729	29·747	36·3	39	36	.....	NW	N	NW	.....	.....	10	8	10	. ...	Rain and fog.
"	25	29·879	30·418	...	39·	43	31	36·	WNW	WNW	.....	.....	.....	1	.	..	Port Burwell. . .	
"	26	30·422	....	29·815	49·	64	39	37·	.....	....	.....	.....	.....	..	..	..	" .	
"	27	29·797		29·703	66·5	72	42	37·	.....	.....	.....	.....	.....	..	..	..	" ..	
"	28	29·672	29·649	29·650	54·6	68	47	36·	.....	.....	.....	.....	.....	8	9	..	" ..	Showers.

APPENDIX I.—Meteorological Observations taken on board Dominion Government Steamer 'NEPTUNE'—*Concluded.*

Date.	Barometer: at Sea Level.			Thermometer.			Temperature of Sea.	Direction of Wind.			Anemometer.		Clouds.			Location.	Remarks.
1904.	7.	1.	7.	Mean.	Max.	Min.		7.	1.	7.	Miles per day.	Rate per hour.	7.	1.	7.		
July 29	29·751	29·773	29·810	45·	53	39	36·	SW	W	.....	..	.....	10	7	3	Port Burwell ...	Rain.
" 30	29·572	29·495	29·522	46	46	36	35·	NE	NE	N	....	....	10	10	10	" ..	"
" 31	.....	29·567	29·406	48·3	60	36	35·	.....	N	NW	.	....	4	3	4	" ..	
	Average, 29·683....			43·07	72												
	High, 30·522....																
	Low, 29·152....				31												
Aug. 1	29·327	29·428	29·506	44·6	50	42	....	S	S	.....	.....	.....	10	10	10		
" 2	29·526	29·521	29·568	42 3	47	35	36·5	.....	S	S	.....	.....	5	5	5	Resolution Isd..	
" 3	.....	29·771	29·820	38·5	42	27	33·0	.....	SE	SE	.....	.....	..	5	..		
" 4	29·896	29·895	29·910	39·0	42	35	37·0	.....	.....	.....	.....	.....	*	*	..		
" 5	29·930	29·929	29·926	41·0	42	32	..	.....	.....	.....	.....	.....	*	*	7		
" 6	29·924	29·934	29·940	40·3	48	34	40·5	.....	.....	.....	.....	.....	*	*	..	Off Disko, Greenland.	
" 7	29·951	...	29·433	42·5	45	30	40·0	.....	.....	.....	..	..	..	..	..	Devils Thumb..	
" 8	.	29·892	29·935	39·0	43	25	34·0	SW	SW	SW	....	..	10	10	10	N. of Cape York	Rain.
" 9	30·001	29·995	30·009	47·0	53	..	36·0	WSW	WSW	WSW	....	.....	..	4	..	Parkers Snow bay.	
" 10	.....	29·912	29·917	46·5	53	38	36·0	.	.....	.....	...	.....	..	..	..	Englefield's gulf.	
" 11	29·929	29·928	29·877	36·3	43	31	38·0	.....	.....	.....	....	.....	..	..	..	Englefield's gulf.	
" 12	29·684	29·618	29·554	39·3	42	23	36·0	.....	.....	.....	....	.....	..	..	5	Cape Sabin.	
" 13	29·442	.....	29·424	42·3	50	34	37·0	.....	.....	.....	.....	....	10	10	10	Lancaster Sound.	
" 14	29·136	29·215	29·343	40·0	47	37	35·0	.....	.....	.....	...	..	10	10	10	Cuming Creek.	
" 15	.....	.....	.....	.....	48	30	32·0	Strong.		.....	.....	.....	10	10	10	" "	
" 16	29·457	29·592	29·687	40·0	43	36	32·0	Moderating.		.....	...	.....	..	..	..	Beechey island.	
" 17	29·758	29·770	29·832	34 3	40	30	32·0	Gale.		SW	....	.....	..	..	..	Pt. Leopold.	
								SW	SW	SW	.....	..	5	7	8	Prince Regents inlet.	Fog.
" 18	30·001	30·032	30·023	37·6	39	30	32·0	Various.		.....	.....	.....	..	2	..	Byan Martin Is.	Rigging coated with [ice.]

"	19	.....	29·996	29·881	37·6	44	30	36·0	"	.....	.....	.....	..	10	10	Ponds inlet	....	
"	20	29·881	29·838	29·749	43·6	48	35	34·0	Various to gale.	....	....	....	10	10	10	"	....	
"	21	.....	29·693	.....	43·0	48	35	32·0	.....	.....	....	.....	....	..	10	10	"	....	Fog.
"	22	29·773	29·772	29·777	35·0	38	32	32·0	.....	.....	.. ....	....	....	*	*	..	"	..	
"	23	29·771	29·694	29·640	32·6	37	27	32·5	E	.....	.....	.....	.....	..	..	..	"	....	Snowstorm.
"	24	29·720	29·735	29·754	35·3	39	25	31·0	N	... ...	....	..	....	5	8	8	"	....	
"	25	29·701	29·709	29·756	38·0	42	29	34·0	.....	.....	.....	.....	.....	2	3	..	"	..	
"	26	29·837	29·813	29·811	36·6	42	21	36·0	.....	.....	S	....	.....	..	10	10	"	...	Rain and fog.
"	27	29·717	29·680	....	34·3	35	31	....	NNW	N	N	.....	..	10	9	10	"	....	Fog.
		Average.	29·475	...	38·02													
		High,	30·032	....	.....	53												
		Low,	29·136	....	.....	...	21											

* Fog.

APPENDIX II.

LIST OF BIRDS AND EGGS IDENTIFIED OR COLLECTED ON THE VOYAGE OF THE 'NEPTUNE' TO HUDSON BAY AND NORTHWARD.

Skins and eggs of a large number of the following species were collected and preserved by Mr. Andrew Halkett, naturalist to the expedition. He has been assisted in the identification by Prof. Macoun and the Rev. Mr. Eifrig.

The notes on the distribution, etc., are supplied by Mr. Low.

Gavia arcticus (Linn.)—Black-throated Loon.

Skins and eggs collected at Fullerton and Southampton island, Hudson bay. Very common in the waters of Roes Welcome, especially on the east side along Southampton island. Seen in the bays of Baffin island. Breeds abundantly on Southampton; nests built on islands or along the swampy edges of ponds not far from the coast. Feeds in the sea.

Gavia lumme (Gunn.).—Red-throated Loon.

Common along the shores and islands of Hudson bay and Hudson strait, to the northward of James bay. Seen on the north coast of Greenland and in all the northern waters. Breeds on islands or shores of ponds, not far from coast. Feeds in the sea and fresh water. Skins and eggs from Fullerton and Southampton.

Cepphus mandtii (Licht.).—Mandt Guillemot.

Common everywhere in Hudson Bay and in smaller numbers northward. Breeds on islands under large broken rocks, usually talus, at the bottom of cliffs. Skins and eggs collected at Fullerton and obtained at Cape Chidley.

Uria lomvia (Linn.).—Brunnich Murre.

Common everywhere in the north where the coasts are sufficiently high to afford nesting places. Not common in the northwest part of Hudson Bay, owing to the low shores. Seen in numbers at the mouth of Fox channel and in Hudson strait. Plentiful on the Greenland coast as far north as Smith sound.

Uria lomvia (Linn.).—Brunnich Murre—*Continued.*

Common along Ellesmere and North Devon and southward along east coast of Baffin. Breeds in great numbers at Cape Wolstenholme, Digges islands and other places in Hudson strait. Remains in the open water of Hudson bay throughout the winter, numbers having been killed at that time at Fullerton. Skins and eggs, the latter from Cape Chidley.

Alle alle (Linn.).—Dovekie.

Not common in Hudson bay or strait. Found there in the winter, but rarely seen in the summer. Very abundant along the north Greenland coast, less so along the western side of Baffin bay. Seen in Lancaster sound. Eggs from Cary island in Smith sound.

Megalestris skua (Brunn.).—Skua.

Common in Davis strait and Baffin bay; also seen in the eastern part of Hudson strait. Not seen in Hudson bay.

Stercorarius parasiticus (Linn.).—Parasitic Jaeger.

Common about Roes Welcome, where it preys on the Arctic terns; less common farther north. Eggs from Southampton. Nest on islands in ponds. Skins from Roes Welcome.

Stercorarius longicaudus, Vieill.—Long-tailed Jaeger.

Less common than the former species in Roes Welcome, and seen occasionally in the waters to the northward. Skins from Fullerton and Southampton; eggs from Southampton and Cape Chidley.

Pagophila alba (Gunn.).—Ivory Gull.

Occasional birds of this species are seen in the early summer among the heavy ice on the Atlantic coast of Labrador and in Hudson strait. A specimen of the young in full plumage was shot at Fullerton in the end of September.

Rissa tridactyla (Linn.).—Kittiwake.

Not very common in the northern part of Hudson bay or elsewhere in the north. Specimen from Fullerton.

Larus glaucus, Brunn.—Glaucous Gull.

The common big gull of the north. Common about Fullerton and frequently seen along the northern coasts. Skins and eggs from Fullerton and Cape Chidley.

Larus marinus (Linn.).—Great Black-backed Gull.

A large colony seen on the high cliffs of Cuming creek, North Devon, and in other inaccessible places on the northern islands. Eggs from the islands off Cape Chidley.

Larus argentatus, Brunn.—Herring Gull.

Very common everywhere in Hudson bay; less so in the northern waters, where its place appears to be taken by the Fulmars and Skuas. Skins and eggs from Fullerton.

Xema sabinii (Sab.).—Sabine Gull.

Common in Roes Welcome, about Whale point and on the Southampton side. Flies with the Arctic Terns and also builds its nest along with those birds on the small islands in the ponds of Southampton. Skins and eggs from Southampton island.

Sterna paradisæa, Brunn.—Arctic Tern.

Very common along both sides of Roes Welcome. Breeds on the islands along the west coast and on islands in the ponds of Southampton island.

Common in Roes Welcome, about Whale point and northward.

Fulmarus glacialis (Linn.).—Fulmar.

Very common along the Atlantic coast of Labrador, especially about Cape Chidley. Common northward to Smith sound; very numerous off Hall island, on the north side of Frobisher bay.

Harelda hyemalis (Linn).—Old-squaw.

Very common in the northern parts of Hudson bay and on the Arctic islands. Breeds on the islands of the ponds. Remains in the open water of Hudson bay throughout the winter. Numbers killed at that season at Fullerton. Skins and eggs from Fullerton and Southampton.

Somateria mollissima borealis (Brehm.).—Northern Eider.

A number shot along with the American Eider, in the neighbourhood of Fullerton. Skins from Fullerton.

Somateria dresseri, Sharpe.—American Eider.

Common everywhere in Hudson bay and to the northward, wherever small islands are found along the shores suitable for breeding. Very common on the west side of Roes Welcome, but rare on the opposite side owing to the absence of small islands fringing Southampton. Skins and eggs from Fullerton.

Somateria spectabilis (Linn.).—King Eider.

Common in the northern part of Hudson bay, especially so about the limestone islands, where they breed on the islands of the numerous ponds. Do not breed on the islands like the American Eider. Very numerous on the east side of Roes Welcome. Skins and eggs from Fullerton and Southampton.

Branta canadensis hutchinsii (Rich.)—Hutchins Goose.

Numerous in the spring about Fullerton. Found breeding on Southampton in end of June. Nests in swampy ground, built up of moss and grass. Skins and eggs from Southampton.

Branta canadensis hutchinsii (Rich.).—Hutchins Goose.

Common about Fullerton in the spring. Breeds along with the Lesser Snow Goose on Southampton. Skins from Fullerton and Southampton.

Olor columbianus (Ord.).—Whistling Swan.

Common on Southampton island, where it breeds in a large nest of moss and grass in the swampy ground about the ponds. Skins and eggs from Southampton.

Grus canadensis (Linn.).—Little Brown Crane.

Several pairs seen on Southampton island. Breeds there. Skins from Southampton.

Crymophilus fulicarius (Linn.).—Red Phalarope.

Very common about Fullerton and on Southampton island, breeding in swampy ground. Skins and eggs from Fullerton and Southampton.

Tringa fusicollis, Vieill.—White-rumped Sandpiper.

Breeds in the swampy ground about Fullerton. Skins and eggs.

Tringa minutilla, Vieill.—Least Sandpiper.

Found breeding about Fullerton. Skins and eggs.

Tringa alpina pacifica (Coues).—Red-backed Sandpiper.

Found breeding about Fullerton. Skins and eggs.

Ereunetes pusillus (Linn.).—Semipalmated Sandpiper.

Common everywhere in Hudson Bay. Skins and eggs from about Fullerton.

Calidris arenaria (Linn.).—Sanderling.

Found breeding about Fullerton. Skins and eggs from Fullerton.

Squatarola squatarola (Linn.).—Black-bellied Plover.

Found at Whale point, Roes Welcome, evidently breeding there.

Arenaria interpres (Linn.).—Common Turnstone.

A few small flocks seen about Fullerton.

Lagopus ruspestris (Gmel.).—Rock Ptarmigan.

The Rock Ptarmigan is found throughout the year in the neighbourhood of Fullerton, but only in small numbers during the winter, the main body migrating southward early in October. Thousands at that date were seen crossing Chesterfield inlet, in flocks numbering up to several hundreds. They return from the south in May, usually in pairs or small flocks. Skins from Fullerton. Eggs from Cape Chidley.

Archibuteo lagopus sancti-johannis (Gmel.).—Rough-legged Hawk.

A few seen about Fullerton in the spring. A young bird remained on board the 'Neptune' for two days, coming aboard several miles off Cape Chidley, in a dense fog.

Falco islandus, Brunn.—White Gyrfalcon.

Seen along the highlands of the south side of Hudson strait. Skins and eggs from Cape Chidley.

Falco peregrinus anatum (Bonap.).—Duck Hawk.

The Duck Hawk is more common than the Gyrfalcon, breeding on the face of steep cliffs, and making its presence known by its shrill cries. Skin from Fullerton. Eggs from Cape Chidley.

Nyctea nyctea (Linn.).—Snowy Owl.

A few specimens were seen in the early spring about Fullerton. They are reported by the natives to breed inland. At Cape Dufferin on the east side of Hudson bay, upwards of thirty of these birds were caught by placing fox traps on the top of short poles, at intervals along the coast, during the southern migration of the birds in October, 1901.

Octocoris alpestris hoyti, Bishop.—Hoyt Horned Lark.

This species was common at Fullerton in June, feeding along with Snowflake and Longspur on the garbage about the ship. A number were caught in traps. Skins and eggs from Fullerton.

Corvus corax principalis, Ridgw.—Northern Raven.

The Raven is found sparingly everywhere in the north. A pair remained throughout the winter in the neighbourhood of Fullerton. Skin from Fullerton. Eggs from Cape Chidley.

Acanthis linaria (Linn.).—Redpoll.

A few seen about the ship in the spring at Fullerton. Common on the east side of Hudson bay, to the northern tree-limit. Skins and eggs from Cape Chidley.

Passerina nivalis (Linn.).—Snowflake.

Very common everywhere in the north. Comes from the south at the first signs of spring. Nests everywhere; nests, on grass and feathers, usually hidden beneath a large boulder. Skins and eggs from Fullerton and Cape Chidley.

Calcarius lapponicus (Linn.).—Lapland Longspur.

Found everywhere along with the Snowflake. Eggs and skins from Fullerton. Nest of grass with few feathers, not hidden.

Anthus pensilvanicus (Lath.)—Pipit.

The Pipit is common along the shores of Hudson bay. Skins and eggs from Fullerton.

APPENDIX III.

LIST OF PLANTS COLLECTED IN 1904 DURING THE CRUISE OF THE NEPTUNE.

(By L. E. Borden, M.D., and named by Mr. J. M. Macoun.)

The letters after the species indicate the localities at which they were collected. The localities and dates at which collections were made are shown below.

July 10, Fullerton island	F.
" 28–29, Port Burwell	D.
Aug. 9, Parker Snow bay	S.
" 11, Cape Sabine	A.
" 13, Cuming creek	C.
" 15, Beechey island	B.
" 20, Ponds inlet	P.
Sept. 31, Wakeham bay	W.

	F.	D.	S.	A.	C.	B.	P.	W.
Ranunculus nivalis, L.			*		*		*	*
" pygmæus, Wahl		*						
Arabis alpina, L.		*						
Draba alpina, L.				*	*	*	*	
" Bellii, M.H.M.		*					*	
" Wahlenbergii, Hartm.	*				*			
Cochlearia Groenlandica, L.	*							*
Cerastium alpinum, L.	*	*	*				*	
Lychnis apetala, L.		*		*			*	
Silene acaulis, L.	*		*					
Stellaria longipes, Goldie	*	*					*	
Astragalus alpinus, L.		*					*	
Oxytropus Bellii, (Britt.)	*							
" leucantha, Pers.							*	
Dryas integrifolia, Ch. & Schl.	*	*			*	*	*	
Potentilla emarginata, Pursh		*					*	
" maculata, Pour.		*						
Saxifraga Aizoon, Jacq.							*	
" caespitosa, L.	*							
" cernua, L.		*				*	*	
" flagellaris, Willd				*				
" Hirculus, L.					*		*	
" oppositifolia, L.	*		*	*			*	
" rivularis, L.	*							*
" tricuspidata, Retz.			*				*	
Sedum Rhodiola, DC.		*						
Epilobium latifolium, L.		*					*	
" spicatum, Lam.		*						
Antennaria alpina, Gaertn.		*						
Arnica alpina, L.							*	

	F.	D.	S.	A.	C.	B.	P.	W.
Erigeron uniflorus, L		*						
" debilis, Gray		*						
Taraxacum ceratophorum, Lange		*						
Campanula uniflora, L		*					*	
Arctostaphylos alpina, Spreng		*						
Cassiope tetragona, Don	*						*	
Bryanthus taxifolius, Gray		*						
Pyrola pumila, Hook		*					*	
Vaccinium uliginosum, L	*	*					*	
Diapensia Lapponica, L		*						
Armeria vulgaris, Willd		*						
Pedicularis hirsuta, L			*		*		*	
" flammea, L		*						
" lanata, Cham	*							
Veronica alpina, L		*						
Oxyria digyna, Hill		*					*	
Polygonum viviparum, L		*					*	
Empetrum nigrum, L		*						
Salix anglorum, Cham	*	*	*		*		*	
" herbacea, L		*						
" Labradorica, Rydb		*					*	
" reticulata, L		*					*	
" Uva-ursi, Pursh		*						
Tofieldia borealis, Wahl		*						
Luzula campestris, DC			*					
Carex hyperborea, Drej		*						
Eriophorum capitatum, Host			*					
" polystachyon, L	*		*		*		*	
" vaginatum, L		*						
Alopecurus alpinus, L							*	
Colpodium latifolium, R. Br			*				*	
Hierochloa alpina, R. & S	*	*	*				*	
Poa arctica, R. Br		*	*					
Equisetum arvense, L	*							*
Lycopodium Selago, L	*							*

APPENDIX IV.

NOTES ON THE FOSSIL CORALS COLLECTED BY MR. A. P. LOW AT BEECHEY ISLAND, SOUTHAMPTON ISLAND AND CAPE CHIDLEY, IN 1904.

(By Lawrence M. Lambe, F.G.S., F.R.S.C.)

BEECHEY ISLAND, LANCASTER SOUND.

Acervularia austini (Salter). 1852. Sutherland's voyage*, appendix, p. ccxxx, Strephodes? Austini, pl. 6, figs. 6, 6a.

The type specimens of this species were obtained at Cornwallis, Beechey and Griffiths islands. A number of corals in Mr. Low's collection, from Beechey island, appear to belong to this species, judging from Salter's description and figures and those of Houghton in the Journal of the Royal Dublin Society, vol. 1, 1856-57 (1858), p. 246, pl. x., figs. 2, 2a.

In Mr. Low's specimens the inner structure is fairly well shown. The larger septa pass to the centre of the corallites where they are slightly twisted, and together with the arched, rather vesicular tabulæ, form a definite central area that appears at the bottom of the cups as a more or less distinct boss. The septa (averaging from thirty to forty in number) bear arched carinæ on their sides. The corallites are slightly larger than those of *A. gracilis*** (Billings), from Grand Manitoulin island, Lake Huron (Niagara group), otherwise the specimens could with equal propriety be referred to the Lake Huron species. The size of the corallites varies in *A. austini* from about 3 to 8 mm. in diameter, in Mr. Low's specimens up to about 10 mm. across, but in *A. gracilis* the corallites seldom reach a diameter of 7 mm. If by a direct comparison it is found that Mr. Low's specimens are without doubt properly referable to *A. austini,* and if it can be shown that the size of the corallites cannot be relied on as a specific character, then *A. gracilis* may have to be regarded as identical with *A. austini.*

* Journal of a voyage in Baffin's bay and Barrow straits in the years 1850-1851 by Peter C. Sutherland, M.D., M.R.C.S.E., 1852.

** *Strombodes gracilis.* 1865 Geological Survey of Canada, Palæozoic Fossils , vol. 1, p. 113, fig. 94, by E. Billings ; and *Acervularia gracilis,* 1900, Contributions to Canadian Palæontology, vol. IV, pt. II, pl. XIV, figs. 2, 2a, by Lawrence M. Lambe.

Two specimens of corals from Beechey island are not referable to any genus with which the writer is acquainted. In these specimens the structure is revealed, by weathering at the calicular surface and in horizontal and longitudinal sections, as well as in sections obtained by rubbing down and polishing. As the writer is unable to place this coral, to his satisfaction, in any described genus, it is thought best to establish a new genus for its reception. The main generic characters are enumerated below with a brief description of the species which the writer has much pleasure in naming after Mr. Low.

Boreaster. Gen. nov.

Corallum composite, massive (or thickly incrusting), made up of intimately connected polygonal corallites communicating with each other by means of mural pores. Septa in the form of longitudinal lamellæ, twelve in number. Tabulæ simple.

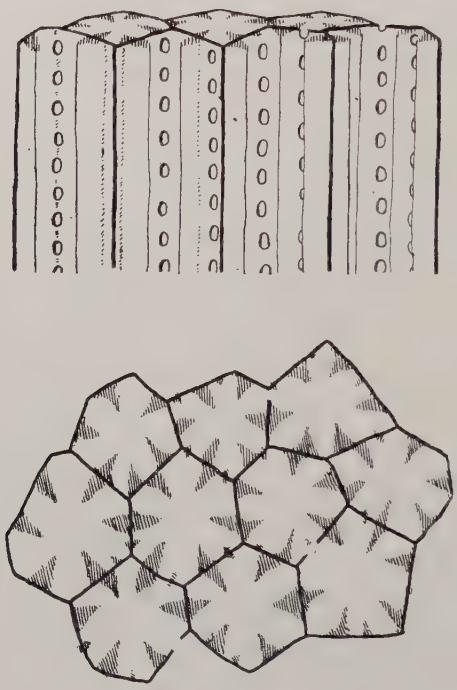
This genus resembles *Favosites* in having numerous pores in the walls of the corallites, but differs from it in the possession of lamellar septa somewhat similar to those of *Columnaria, Nyctopora* and *Lyopora.* From these three genera, however, *Boreaster* differs in having 12 septa only, of two alternating sizes, to a corallite. *Columnaria* and *Lyopora* are without mural pores. *Nyctopora* was described by Nicholson as having pores, but in well preserved specimens from the type locality, examined by the writer, mural pores were not seen; it possesses 16 septa of two orders. *Boreaster* and *Calapœcia* resemble each other in both having pores, but in the latter genus the corallites are not intimately united under any circumstances, and the septa are in the form of spine-bearing ridges.

This interesting coral may be conveniently grouped with the *Favositidæ,* as its generic affinities appear to place it close to *Calapœcia.*

Boreaster lowi. Sp. nov.

Corallum growing in irregularly shaped masses with an unevenly undulating surface; composed of small, polygonal corallites so closely united that all trace of the line of contact between contiguous walls is apparently lost. Corallites opening at right angles to the surface, averaging about 75 mm. in diameter and generally five or six sided, as seen in transverse section, the sides of the polygons being distinctly

unequal. Walls of corallites thin but less so where they bound the calyces. Septa lamallar, apparently 12 in number, of two sizes, primary and secondary, alternating, the former stout and relatively large, the latter rudimentary and observed with difficulty, especially in the calyces where the six primary septa are paramountly evident, are slightly exsert and apparently connect with the nearest and cor-



X20

responding ones of contiguous corallites. Pores relatively large, oval, their greater diameter vertical, in a single longitudinal row between each pair of primary septa so as to interrupt the continuity of the secondary septa which are greatly reduced and in transverse sections are only observed in places. Tabulæ not numerous, in the form of simple, flat transverse diaphragms.

The two type specimens have a maximum length of 50 and 70 mm. with a thickness or height of 25 and 30 mm. respectively.

Favosites gothlandica, Lamarck.

There are three examples of this coral, of which two show spiniform septa in the corallites. The smaller of the two specimens, in which septa are seen, is preserved with a small corallum of *Acervularia austini* in the same piece of limestone.

The horizon indicated by the first and last of the above three species of corals from Beechey island would be about that of the Niagara formation.

SOUTHAMPTON ISLAND, HUDSON BAY.

Streptelasma robustum, Whiteaves.

This large and well marked species, described originally from the Galena-Trenton of the Lake Winnipeg region, is represented by a number of more or less fragmentary specimens. The inner structure is well shown in transverse and longitudinal sections.

Favosites gothlandica, Lamarck.

Over forty specimens from this locality are referable to this well known species. In many of them are seen the spiniform septa, characteristic of all Silurian favosites, and distinguishing them from all Devonian forms which apparently without exception possess linguiform septa. It is possible that more than one species may be here represented. The range in size of the corallites in *F. gothlandica* has been noticed by the writer in his 'Revision of the genera and species of Canadian Palæozoic corals*,' 1899-1900, but in the present collection the fragmentary condition of most of the specimens does not admit of characters dependent on the outward form of the corallum being used with any degree of certainty.

Syringopora verticillata, Goldfuss.

A single specimen of this species was obtained at Southampton island. Its corallites average about 4 mm. in diameter and are rather lax and irregular in their growth, the result of which is that the connecting tubes are poorly developed and comparatively distant. This particular mode of growth is admirably shown in specimens, in the possession of the Survey, from the north end of Lake Timiskaming.

* In this report the reader will find extended references to the structure of the majority of the species mentioned in these notes.

Halysites catenularia, L.

Represented by a small corallum, round which has grown a stromatopora. This coral exhibits the structure characteristic of the typical form of the Niagara formation, viz., moderate sized corallites, oval in transverse section with narrow tubules intervening. Four corallites are included in a space of 8 mm.

This form also occurs in the Guelph limestone of Ontario.

A second and particularly interesting specimen was obtained by Mr. Low at Southampton island. It differs from the typical form in having corallites of noticeably large size, and agrees in this particular with a specimen from the Guelph limestone at Durham, Ont. (J. Townsend, 1884), in the museum of the Survey. The Durham fossil has not the finer details of structure sufficiently well preserved to show the minute tabulæ of the tubules, but in Mr. Low's specimen longitudinal sections of the tubules clearly reveal the highly arched, close set tabulæ within. There are three corallites in a space of 12 mm., as in the Durham specimen, and the tubules have a width of about ·75 mm.

Plasmopora follis, M.-E. and H.

To this species is referred a small specimen showing the inner structure fairly well. The corallites vary in diameter from slightly under to a little over 1 mm., and they are mostly less than their own diameter apart with from one to three tubules, in the shortest line, between neighbouring corallites. This species is generally considered to be typical of the Niagara group.

Pycnostylus elegans, Whiteaves.

A few specimens weathered so as to show only the inside of the corallites which vary in diameter from 7 to 15 mm. An interesting feature of these specimens is the preservation of the free edges of the septa which are seen to be denticulated, about seven denticles occurring in a space of 2 mm. A re-examination of the type material reveals the presence of these denticles, although they are poorly preserved. Mr. Low's specimens are referable to the species from the Guelph limestone of Ontario with large corallites (from 13 to 17 mm. in diameter) as in the other and type species from the same

horizon and district, the corallites are generally smaller (from 3 to 7 mm. in diameter). As suggested by Dr. Whiteaves in his original description, additional material with corallites of intermediate size may prove the two forms to be specifically identical.

Of the corals from Southampton island, *Streptelasma robustum* indicates the presence of beds at this locality that belong to the same horizon as those that have been assigned to the Galena-Trenton in the Lake Winnipeg region, and similar beds exposed over a large area to the west of Hudson bay. The beds from which the other species from the same island are derived belong to higher horizons which are, on the evidence of these species, of about the same geological age as those of the Niagara and Guelph formations of Ontario.

CAPE CHIDLEY, HUDSON STRAIT.

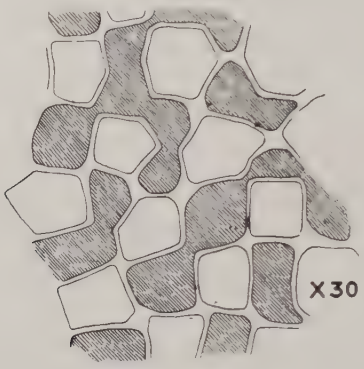
A single coral from this locality is represented by two fragments that have apparently been broken from a larger mass. The exact form of the corallum is unknown, but the structure of the corallites is well preserved and clearly seen in longitudinal and traverse sections. Its structural characteristics are quite different from those of any form known to the writer, and it is regarded as representing a new genus and species named and characterized as follows:—

Labyrinthites. Gen. nov.

Corallum massive, made up of very slender, long, columnar corallites, upwardly directed and parallel, each one connected along the whole of its length with two or three adjacent corallites in tortuous series separated by narrow interspaces. Tabulæ, complete, distant. No septa nor tubules.

Although the manner of growth of this coral resembles somewhat that of *Halysites* it could scarcely be referred to that genus, on account of the absence of septa and tubules, although in *Halysites catenularia* var. *gracilis* tubules are apparently wanting. The small size of the corallites would not necessarily be considered a character sufficient to constitute generic distinction. Another genus, *Fletcheria,* may be considered, but *Labyrinthites* has little in common with it. In both, the tabulæ are distant and simple, practically the only point of resemblance unless we notice the small size of the corallites of *Fletcheria* and the stated rudimentary condition of its septa.

As the want of septa in the Cape Chidley specimens may be due to imperfect fossilization, *Labyrinthites* is, on account of its mode of growth, provisionally classed with the *Halysitidæ*.



Labyrinthites chidlensis. Sp. nov.

Corallum massive, composed of slender, straight, upright corallites with numerous interspaces. Corallites a little less than ·33 mm. in average diameter, quadrangular or five or six sides in transverse outline, with rather thick walls. Each corallite coalesces along its entire length with two or three adjacent ones, giving rise to a meandering succession of tubes inclosing narrow spaces not wider than the corallites themselves. In the specimens examined the corallites reach a maximum length of ·30 mm. In longitudinal sections tabulæ, in the form of thin, flat, transverse plates across the corallites, are observed, between ·5 and 1·5 mm. apart. There are no tubules between contiguous corallites, and the mural union appears to be complete.

Dr. Ami, who is studying the groups of fossils, other than the corals, obtained by Mr. Low at Cape Chidley, informs me that the majority of the Cape Chidley fossils are referable to the Ordovician, whilst two specimens are of Silurian age. The lithological character of the rock in which the coral is preserved appears to more nearly approach that of the Ordovician specimens.

Preliminary List of Organic Remains from Beechey Island, Lancaster Sound, in the District of Franklin.

(Determined by H. M. Ami, Assistant-Palæontologist.)

(*A*)—From the bluish-gray impure limestones.

Coelenterata.

1. *Acervularia austini* (Salter).
2. *Boreaster lowi,* Lambe.
3. *Clathrodictyon? franklinense.* N. sp.

Echinodermata.

4. Crinoidal fragments.

Brachiopoda.

5. *Hindella phoca,* (Salter).

Gasteropoda.

6. *Hormotoma arctica,* N. Sp.
7. " *affinis,* N. Sp.
8. *Lophospira salteri,* (Haughton).
9. *Loxonema rossi,* Haughton.
10. *Holopea borealis,* N. Sp.
11. *Euomphalus beechiensis,* N. Sp.

Pelecypoda.

12. *Orthonota? desiderata,* N. Sp.

Trilobita.

13. *Encrinurus arcticus,* (Salter).

Ostracoda.

14. *Leperditia hisingeri,* Schmidt.
15. " *balthica,* (Hisinger) var. *arctica,* Salter.
16. *Isochilina grandis,* (Schrenk) Jones, var. *canadensis,* N. var.
17. *Primitia mundula,* Jones, var. *arctica,* N. Var.
18. *Beyrichia kloedeni,* McCoy.

Besides the above, there are remains of the tracks and trails of Annelida which cannot be identified with any described form, and to them have been given specific designations as follows:—

19. *Eugyrichnites lowi,* N. Sp.
20. *Planolites arcticus,* N. Sp.

(*B*)—From the yellowish-gray, semi-crystalline, limestone:

COELENTERATA.

1. *Strephodes pickthornii,* Salter.
2. Obscure remains of some form of hydroid which appears to indicate the presence of a species of graptolite, too imperfectly preserved for identification.

ECHINODERMATA.

3. Crinoidal fragments.

BRACHIOPODA.

4. *Orthothetes donnettii,* (Salter).
5. *Rafinesquina?* sp. indt.
6. *Hindella phoca.* (Salter).
7. *Glassia?* sp. indt.
8. *Plectambonites?* sp. indt.

GASTEROPODA.

9. *Hormotoma arctica,* N. Sp. Resembles the form figured by Salter in his 'Geology' in the Appendix to Sutherland's 'Journal of a Voyage,' &c. Pl. V., fig. 18, 1852.
10. *Hormotoma,* sp., cf. *H. affinis,* N. Sp.
11. *Loxonema,* sp. Resembles some of the forms classed under the designation *L. rossi,* Haughton, but separable from the narrower types to which the species is restricted.

TRILOBITA.

12. *Proetus,* sp. indt. Pygidium.
13. *Encrinurus??,* sp. indt. Portion of the head of an individual, not sufficient for identification.

OSTRACODA.

14. *Primitia,* sp. A very elongate form resembling *P. cylindrica,* (Hall).
15. *Primitia,* sp. No. 2. Distinct from above.

Preliminary Lists of the Species of Organic Remains from Blocks of Limestone from Southampton Island.

(*A*)—From a piece of yellowish limestone:

Echinodermata.

1. Crinoidal fragments.

Brachiopoda.

2. A strongly camerate form of strophomenoid shell, probably a *Strophodonta.*
3. *Orthothetes?* sp.
4. *Camarotœchia ekwanensis,* Whiteaves.
5. " sp.
6. *Retzia,* sp.

Gasteropoda.

7. *Pleurotomaria,* sp. of the type of *P. alta,* Hisinger.
8. " sp. of the type of *P. perlata,* Hall.

Trilobita.

9. *Encrinurus,* sp., cf. *Encrinurus punctatus,* Emmrich.
10. *Proetus,* sp. indt.

Ostracoda.

11. *Primitia,* sp. indt.

(*B*)—From a small piece of drab coloured dolomitic limestone:

Brachiopoda.

1. *Orthis,* sp. of the type of *Orthis (Dinorthis) subquadrata,* Hall.
2. *Rhynchonella,* sp.
3. *Glassia?,* sp. indt.

Ostracoda.

4. *Primitia,* sp. indt.

(*C*)—From a small piece of dark-brown bituminous shale:

Pisces.

1. Obscure remains of some species of fish, too imperfectly preserved for identification. This shale appears to resemble the Niobrara-Benton shale of the Manitoban region.

(*D*)—In a small piece of buff limestone:

BRACHIOPODA.

1. Small shell of the type of *Glassia,* possibly the same as the *Glassia variabilis,* (Whiteaves) from the Silurian of the Ekwan river district.
2. *Rhynchospira,* sp. or *Retzia,* sp. A finely ribbed shell, not sufficiently well-preserved to be identified with any degree of certainty.
3. *Conchidium,* sp. a small and immature form of what appears to be the *Conchidium decussatum,* Whiteaves.

GASTEROPODA.

4. *Murchisonia* (*Hormotoma*), sp. indt.
5. *Loxonema,* sp. An imperfect individual with seven whorls preserved, having an apical angle of 10°, and would require at least three more volutions to complete the shell at this stage.

(*E*)—In impure limestone:
stone:

BRACHIOPODA.

1. *Strophomena* (*Rafinesquina*) *alternata,* (Emmons) Conrad. Three valves of this species appear to be represented in this small slab of rock, and exhibit the characteristic sculpture and other surface characters.

(*F*)—In cream-coloured dolomite:

BRACHIOPODA.

1. *Camarotœchia,* sp. possibly the same as the *Camarotœchia ekwanensis,* Whiteaves.

OSTRACODA.

2. A very large Ostracod, which is not in a good state of preservation, but which, from its size and general characters appears to be close to *Isochilina grandis*

(*G*)—In a drab-coloured limestone.

BRACHIOPODA.

1. *Strophomena,* sp. of the type of *Strophomena euglypha,* Sowerby. The sculpture of this shell is very much like that of *Strophomena* (*Rafinesquina*) *alternata,* Conrad.

2. Pentameroid shell, not sufficiently well preserved to state definitely whether it is *Pentamerus oblongus* or not, but it strongly resembles a dorsal valve of this well-known form from the Silurian of Europe and North America.

This rock resembles strongly the rock of Mansfield island, where Dr. Bell obtained a number of fossils, determined by the writer to be Silurian, and possibly homotaxial with the Wenlock and Niagara formations.

(*H*)—In a dark dolomitic limestone.

BRYOZOA.

Some species of bryozo appear in the collection.

BRACHIOPODA.

1. *Strophomena,* sp.
2. *Strophomena,* sp., cf. *S. acanthoptera,* Whiteaves.
3. A rhynchonelloid form which appears to be the *Camarotœchia ekwanensis,* Whiteaves.
4. A smooth form of shell which may be the *Glassia variabilis,* Whiteaves.

OSTRACODA.

5. Undetermined forms or imperfectly preserved forms.

(*I*)—In a rather dark buff-weathering limestone:

BRACHIOPODA.

1. *Leptæna* (*Plectambonites*) *sericea,* Sowerby. A form with winged extremities of hinge area.
2. *Strophomena,* of the type of *S. nitens,* Billings.
3. *Orthis* (*Dalmanella*), sp., cf. *D. testudinaria,* Dalman.
4. *Rhynchonella,* sp. type of *R. neglecta,* Hall. This may be the *Camarotœchia ekwanensis,* Whiteaves.
5. A smooth brachiopod which may be a *Glassia.*

(*J*)—In a small slab of drab-coloured limestone.

1. Obscure remains of *algæ* or other plants.

(*K*)—In a slab of yellow weathering dolomite:

1. *Camarotœchia ekwanensis,* Whiteaves.
2. Smooth and small *Glassia*-like brachiopod, too imperfect for identification.
3. Obscure remains of a trilobite, indeterminable.

(*L*)—In a drab-coloured limestone:

1. *Pentamerus oblongus,* Sowerby. These forms resemble closely those determined by the writer in Dr. Bell's collections from Mansfield island.

(*M*)—In a dark mottled buff and gray dolomitic limestone:

BRACHIOPODA.

1. *Strophomena,* sp., of the type of *S. hecuba,* Billings.
2. " (*Rafinesquina*) *alternata,* (Emmons) Conrad. This limestone appears to be homotaxial with the Trenton of Ontario and the Galena-Trenton of the Manitoba region.

(*N*)—In a yellow weathering dolomitic limestone:

BRACHIOPODA.

1. *Strophomena,* sp., or strophomenoid shell with *alternata*-type of sculpture.
2. *Camarotœchia,* sp., cf. *C. ekwanensis,* Whiteaves.
3. *Glassia?,* sp. indt.

OSTRACODA.

4. *Leperditia,* sp., cf. *Leperditia hisingeri,* Schmidt.
5. *Primitia,* sp. indt.

(*O*)—In a drab coloured dolomitic limestone:

CEPHALOPODA.

1. A portion of some gyroceran or orthoceratite shell; resembles in some respects the external characters of *Orthoceras nicolleti* figured in Vol. iii., part 11, of the Palæontology of Minnesota, Pl. 55, fig. 1.

(*P*)—In a yellowish-gray dolomitic limestone:

CEPHALOPODA.

1. *Actinoceras keewatinense,* Whiteaves. Several siphuncles of this species recently described by Dr. Whiteaves occur in the collections from Southampton island.

(*Q*)—Collections of Stromatoporoids from Southampton Island:

Sixty-three microscopic sections have been submitted to a preliminary examination, and the following species among others, appear to occur:—

1. *Clathrodictyon regulare,* Rosen.
2. " *fastigiatum,* Nicholson.
3. " sp., cf. *C. striatellum,* Nicholson.
4. " (?) *crassum.* Nicholson.

Some of these are parasitic on *Favosites Gothlandicus,* Lamarck. They are referable to the Silurian, about the age of the Niagara.

PRELIMINARY LIST OF ORGANIC REMAINS FROM LOOSE BLOCKS OF LIMESTONE, CAPE CHIDLEY.

(*A*)—From the drab-coloured limestone:

POLYZOA.

1. *Pachydictya,* sp. indt.

BRACHIOPODA.

2. A strophomenoid shell with sculpture of *Strophomena varistriata* type occurs in the collection with *Sieberella galeata.*
3. *Trematospira,* sp. indt.
4. *Conchidium decussatum,* Whiteaves.
5. *Clorinda,* sp. probably a new form which I would designate, *Clorinda lowi,* N. Sp.
6. *Sieberella galeata,* Dalman. A form which is very near the type of this cosmopolitan species. If it prove a variety or mutation, I should designate the same as var. *Chidleyensis,* N. var.

The above are all of Silurian age.

(*B*)—From a dark gray impure limestone resembling that of the Black River and Trenton formations of southern Canada:

CEPHALOPODA.

1. *Eurystomites undatus.* Emmons.
2. *Plectoceras obscurum,* Hyatt; or some closely related species.
3, 4 and 5. Three species of *Orthoceras,* as yet undetermined. They are not well preserved and require better specimens before they can be identified. These are probably of the age of the Trenton of southern Canada.

(*C*)—From a slab of bituminous shale:

1. *Asaphus latimarginatus,* Hall. I cannot distinguish this form from the species usually designated in Canada as *Asaphus canadensis,* Chapman, from the Utica shale.

APPENDIX V.

List of the Principal Works and Papers Consulted in the Preparation of the Report on the Dominion Expedition to Hudson Bay and the Arctic Islands.

In the following list are included the full titles and dates of publication of works and papers affording information which has been embodied in the foregoing pages or in the accompanying map:—

A Voyage of Discovery, for the Purpose of Exploring Baffin's Bay, etc., by Sir John Ross, in 1818, London, 1819. Geological appendix by Dr. McCulloch.

Narrative of a Journey to the Shores of the Polar sea in the years 1819-22, by Capt. J. Franklin, London, 1823. Appendix i., by J. Richardson, M.D.

Journal of a Second Voyage for the Discovery of a Northwest Passage, etc., 1821-23, by Captain Parry, London, 1824.

A Supplement to the Appendix to Capt. Parry's Voyage for the Discovery of a Northwest Passage in the year 1819-20 (Natural History) London, 1824. Notes on Rock Specimens by Charles Koning.

A Brief Account of an Unsuccessful Attempt to reach Repulse Bay, etc., by Capt. G. F. Lyon, London, 1825.

Journal of a Third Voyage for the Discovery of a Northwest Passage, etc., by Capt. W. E. Parry, London, 1826. Appendix by Prof. Jameson on Geology of Countries discovered during Capt. Parry's Second and Third Expeditions.

Narrative of a Second Expedition to the Shores of the Polar Sea in the years 1825-27, by Capt. J. Franklin, London, 1828. Appendix i., by J. Richardson.

Narrative of Discovery and Adventure in the Polar Seas and Regions, by Professors Leslie, Jameson and Hugh Murray, Edinburgh, 1830.

Narrative of a Second Voyage in Search of a Northwest Passage, etc., 1829-33, by Sir John Ross, London, 1835. Appendix on Geology, by Sir J. Ross.

Narrative of the Discoveries on the North Coast of America, etc., 1836-39, by Thomas Simpson, London, 1843.

Narrative of an Expedition to the Shores of the Arctic Sea in 1846-47, by Dr. John Rae, London, 1850.

Journey from Great Bear Lake to Wollaston Land and Explorations along the South and East Coast of Victoria, by Dr. J. Rae, Journ. Royal Geog. Soc., vol. xxii., 1852.

Journal of a Voyage in Baffin's Bay and Barrow Straits in 1850-51, by P. C. Sutherland, M.D., London, 1852. Geological appendix, by J. W. Salter.

On the Geological and Glacial Phenomena of the Coasts of Davis' Strait and Baffin's Bay, by P. C. Sutherland, M.D., Quart. Journ. Geol. Soc., vol. ix., 1853, p. 296.

On Arctic Silurian Fossils, by J. W. Salter, Quart. Journ. Geol. Soc., vol. ix., 1853, p. 312.

A Summer Search for Sir J. Franklin, by Capt. Inglefield, 1853. [Contains a geological appendix. I have seen only the notices derived from this work in the "Arctic Manual" of 1875.]

The Last of the Arctic Voyages, etc., 1852-54, by Sir E. Belcher, London, 1855. Appendix by J. W. Salter on Arctic Carboniferous Fossils, and by Prof. Owen, on Remains of Ichthyosaurus, from Exmouth Island. (See also notes on the Discovery of Ichthyosaurus and other Fossils in the Late Arctic Searching Expedition, by Capt. Sir E. D. Belcher. Report of British Association, 1855.)

On Some Additions to the Geology of the Arctic Regions, by J. W. Salter. Report of the British Association for the Advancement of Science, 1855.

Further Papers Relative to the Recent Arctic Expeditions in search of Sir John Franklin, etc. London, Government, 1855.

On the Geology of the Hudson's Bay Territories and of Portions of the Arctic and Northwestern Regions of America, by A. K. Isbester, Quart. Journ. Geol. Soc., vol. xi. (Also reprinted, without map, in Am. Journ. Sci. and Arts, second series, vol. xxi., 1856, p. 313.)

The Discovery of a Northwest Passage by H.M.S. "Investigator," Capt. R. M'Clure, 1850-54, London, 1857. Geological appendix by Sir R. Murchison.

A Personal Narrative of the Discovery of the Northwest Passage, by A. Armstrong, M.D., late surgeon and naturalist to H.M.S. "Investigator," London, 1857.

Arctic Explorations by Dr. E. K. Kane, Am. Journ. Sci. and Arts, second series, vol. xxiv., 1857, p. 235.

Report from the Select Committee on the Hudson's Bay Company, etc., London, Government, 1857. (Geological map.)

A Narrative of the Discovery of the Fate of Sir John Franklin, by Captain M'Clintock, London, edition of 1859. Geological appendix by Prof. Samuel Haughton. (Geological map.) [Notes on the geological results of M'Clintock's voyages were first published in the Journ. Royal Dublin Society, vol. i., 1857, and vol. iii., 1860. The first mentioned paper is accompanied by a geological map which formed the basis of that subsequently produced in connection with the Appendix to M'Clintock's "Narrative." I have seen only the abstract of these papers by Prof. Haughton, which appears in the "Arctic Manual" of 1875.]

The Polar Regions, by Sir John Richardson, Edinburgh, 1861. (Reprinted from Encyclopedia Britannica. Eighth Edition, 1860.)

Report on the Geological and Mineralogical Specimens collected by C. F. Hall in Frobisher Bay, Am. Journ. Sci. and Arts, second series, vol. xxv., 1863.

Preliminary notice of a small collection of Fossils found by Dr. Hayes on the West Shore of Kennedy Channel, by F. B. Meek, Am. Journ. Sci. and Arts, second series, vol. xl., 1865, p. 31.

Flora Fossilis Arctica, Dr. Oswald Heer, vol. i., 1868; vol. ii., 1871, Fossile Flora des Baren Insel; vol. v., 1878, Die Miocene Flora des Grinnell-Landes; vol. vi., 1880, Beiträge zur Miocenen Flora von Nord-Canada.

Scientific Results of the "Polaris" Arctic Expedition. Nature, vol. ix., 1874, p. 404.

A Whaling Cruise to Baffin's Bay, etc., by A. H. Markham, London, 1874. Appendix C., List of Geological Specimens, by R. Etheridge.

Manual of the Natural History, Geology and Physics of Greenland and neighbouring Regions, etc., edited by Prof. T. R. Jones, London, 1875. [This volume, prepared for the use of Nares' expedition under-

the direction of the Arctic Committee of the Royal Society, contains reprints of portions of several of the works and papers above referred to, with occasional important remarks and memoranda by the editor.]

Arctic Geology, by C. E. De Rance. Nature, vol. xi., 1875. (Geological map.)

On a Fossil Silurian Vertebra from the Arctic Regions, by Prof. A. L. Adams, Proc. Royal Irish Acad., second series, vol. ii., 1875.

L'Expédition Polaire Américaine, sous les ordres du Capitaine Hall. Letter by Dr. E. Bessels. Bul. Soc. Géog., Paris, vol. ix., 1875, p. 297.

Narrative of a Voyage to the Polar Sea During 1875-76, etc., by Capt. Sir G. S. Nares, London, 1878, Appendix xv., Geology, by C. E. De Rance and H. W. Fielden.

Geology of the Coasts of the Arctic visited by the late British Expedition under Capt. Sir George Nares, etc., by Capt. H. W. Fielden and C. E. De Rance, Quart. Journ. Geol. Soc., vol. xxxiv., 1878, p. 556. (Geological map)

Palæontology of the Coasts of the Arctic Lands, visited by the late British Expedition, etc., by R. Etheridge, Quart. Journ. Geol. Soc., vol. xxxiv., 1878, p. 568. (Abstracts of this and the foregoing paper appear in Am. Journ. Sci. and Arts, third series, vol. xvi., p. 139.)

Notes on Fossil Plants Discovered in Grinnell Land, by Capt. H. W. Fielden, etc., by Prof. O. Heer, Quart. Journ. Geol. Soc., vol. xxxiv., 1878, p. 66.

Narrative of the Second Arctic Expedition made by C. F. Hall, Washington, Government, 1879. Appendix iii., by Prof. B. K. Emmerson.

Dr. Franz Boas, Baffin Land. Petermanns Mitteilungen, Ergänzungsheft, Nr. 80, 1885.

Die Geographische Verbreitung der Juraformation, by Neumeyr. Denkschriften der Kaiserlichen Akadamie der Wissenschaften, Vienna, vol. l., 1885.

Encyclopedia Britannica (ninth edition), Greenland, by Robert Brown. Polar Regions, by C. R. Markham. (Geological sketches appended to both these articles.)

Three Years of Arctic Service, an Account of the Lady Franklin Bay Expedition, by Lieut A. W. Greely, New York, 1886.

The Eskimo of Baffin Land and Hudson Bay, by Franz Boaz. Bul. Am. Mus. of Nat. Hist., vol. xix.

On the Lower Silurian (Trenton) Fauna of Baffin Land, by Chas. Schurchert. Proc. U.S. Nat. Mus., vol. xxii., p. 143-177.

A Biological Investigation of the Hudson Bay Region, by Edward A. Prebles, U.S. Biological Surv. North American Fauna, No. 22, 1902.

The Second Norwegian Polar Expedition in the Fram, 1898-1902, by Capt. Otto Sverdrup. Roy. Geog. Journ., vol. xxii., No. 1, pp. 38-56, 1903.

Field Work of the Peary Arctic Club, by Com. R. E. Peary. Bul. Geo. Soc. of Phila., vol. iv., with map.

New Land, Four Years in the Arctic Regions, by Capt. Otto Sverdrup, 1904.

Report on the Hudson Bay Expedition, by Lieut A. R. Gordon, Dept. Marine and Fisheries, 1884-5.

Report on the Second Hudson Bay Expedition, by Com. W. Wakeham, Dept. Marine and Fisheries, 1897.

Reported by the Staff of the Geological Survey of Canada:—

Report on an Exploration of the East Coast of Hudson Bay, by Dr. R. Bell, 1877-8.

Report on the Churchill and Nelson Rivers, by Dr. R. Bell, 1878-9.

Report on Hudson Bay and some of the Lakes and Rivers lying to the West of it, by Dr. R. Bell, 1879-80.

Observations on the Labrador Coast, and on Hudson Strait and Bay, with appendices i-v., Dr. R. Bell, Part DD, 1882.

Observations on the Labrador Coast, and on Hudson Strait and Strait and Bay, with Appendices i-iv. A. P. Low, Part J., vol. iii, 1887-8.

Report on the Labrador Peninsula, A. P. Low, Part L., vol. viii., 1895.

Report on the Doobaunt, Kasan and Ferguson Rivers, and the Northwest Coast of Hudson Bay. J. B. Tyrrell, Part F., vol. ix., 1896.

Report on a Traverse of the Northern Part of the Labrador Peninsula. A. P. Low, Part L., vol. ix, 1896.

Reports on Explorations of the Coasts of Hudson Strait and Ungava Bay. Dr. R. Bell and A. P. Low, Parts L. and M., vol. xi, 1898.

Report on an Exploration of the East Coasts of Hudson Bay and James Bay. A. P. Low, Part D., vol. xiii., 1900.

Report on the Geology and Physical Characters of the Nastapoka Islands, Hudson Bay. A. P. Low, Part DD., vol. xiii.

APPENDIX VI.

Notes on Physical Condition of Eskimos.

(By L. E. Borden, M.D., Surgeon to the Neptune.)

	Aivillingmiut. (Male.)	Aivillingmiut. (Female.)	Aivillingmiut. (Male.)
Age	30 years.	25 years.	35 years.
Weight	168 lb.	142 lb.	177 lb.
Height	5 ft., 4·375 in.	4 ft., 11 in.	5 ft., 6·25 in.
Chest expanded	43 inches.	3 ft., 4 in.	42 inches.
" contracted	40 "		37 "
Girth at navel	32·5 "		
Neck circumference	14·5 "	12·5 inches.	14 "
Upper arm—length	15 "	12 "	15 "
" circumference	13 "	10·5 "	
Forearm—length	17·5 "	15·5 "	17·75 "
" circumference	11·5 "	9·5 "	11·5 "
Leg—length	35·5 "	30 "	29·5 "
" calf circumference	14·5 "		14·5 "
" thigh "	20·5 "		22·5 "
Foot length			
Head—circumference	22·5 inches.	21·5 inches.	22 "
Remarks	About average height in region and of good build, of fair intelligence and a good hunter. Abundance of heavy black hair worn, according to custom, falling over shoulders, and protects ears.	A fair average young married woman of this tribe; lips rather thick, forehead low, nose short, ears rather small, hair heavy and black.	Rather taller and heavier than the average.

NOTES ON PHYSICAL CONDITION OF ESKIMOS—*Concluded.*

	Kenipitumiut. (Male.)	Kenipitumiut. (Female.)	Kenipitumiut. (Male.)
Age	20 years.	65 years.	35 years.
Weight	172 lb.	136 lb.	158 lb.
Height	5 ft., 8·5 in.	4 ft., 11·5 in.	5 ft. 7 in.
Chest expanded	40·5 inches.	38·5 inches.	41 inches.
" contracted	37·5 "	37 "	39·5 "
Girth at navel	33·5 "		35 "
Neck circumference	14 "	11·5 inches.	13·5 "
Upper arm—length	13·5 "	11 "	13 "
" circumference	11·75 "	11 "	10·5 "
Forearm—length	19 "	16 "	17·5 "
" circumference	11 "	9 "	10 "
Leg—length	36·5 "		
" calf circumference	14 "		
" thigh "	22 "		
Foot—length	9·75 "	7·5 inches.	
Head—circumference	22·5 "	21 "	22 inches.
Width of face			5·25 "
Remarks	Tallest of the band at, and muscular and well built, but slow mind and limb.	Typical old woman, two-thirds teeth remaining and perfect; hair, slightly gray, no baldness; eyebrows, arched and thin; eyes, sight fairly well preserved; nose-bridge low and lumpy and prominent; forehead, low, narrow, arched; cheek bones project forward; lower jaw prominent; chin, pointed and short; breasts, long and flabby; no hair on body except in axillæ; arteries hard.	Teeth perfect, though large; eyes bad, due to snow-blindness; eyebrows heavy, black; slight moustache; nose, straight, well formed except bridge, low; forehead, low but broad and square; an intelligent man and a good workman as kyak builder, &c.; unable to hunt, owing to rheumatism; ears, large and stand out from head.

	Kenipitumiut. (Male.)	Kenipitumiut. (Female.)	Kenipitumiut. (Female.)
Age	60 years.	30 years.	17 years.
Weight	138 lb.	123 lb.	117 lb.
Height	4 ft., 11·5 in.	5 ft.	4 ft., 10·5 in.
Chest expanded	37 inches.	32·5 inches.	32·5 inches.
" contracted	33 "	31 "	29 "
Girth at navel	33 "		23·5 "
Neck circumference	14 "	11·5 inches.	12·5 "
Upper arm—length	11·12 "	11 "	11 "
" circumference	12 "	10·5 "	10 "
Forearm—length	16 "	15·5 "	16 "
" circumference	10 "	9 "	9 "
Leg—length		33 "	
" calf circumference		12 "	13·5 "
" thigh "			
Head—circumference	21 inches.	21·5 inches.	21 "
" width of face	5 06 "	4·75 "	4·5 "
" length of face		6·75 "	
Foot—length		8 "	7.5 "
Remarks	Very shrewd and reliable native; well preserved; head, very well shaped; eyes, bright; hair, black and heavy; nose, straight; cheeks, prominent; chin, square and not short; eyebrows, heavy, black; ears, large, prominent.	Typical young married woman; teeth, discoloured and large, though sound; eyes, good; nose, flat; cheek bones, low and prominent, making face look square; no hair on body except slight trace in axillæ; ears, large; chin, short; mouth, large, wide, corners drooping; lips, not thick; hands and feet well formed and small; breasts, very flabby and hang down 4½ inches; instep, arched.	Typical girl; teeth, irregular; cheeks, not very prominent; face, flat; nose, small; ears, left, small, right, no external opening and all external ear except lobe wanting; eyes, good, dark brown; hands and feet well formed; breasts well developed; no hair on body.

INDEX

Aberdeen, 250
Actinolite, 198
Active, 40, 68, 245, 252
Acworth cape, 214
Adams, Capt., 3, 59, 229, 239
Admiralty, 3, 85, 90
Admiralty inlet, 56, 115, 121-123
Advance, 99, 103
Advice, 99
Aivillingmiut, 27, 32, 34, 135-138, 155, 160, 162, 177-180.
Akolingmiut, 134, 137
Akpatok island, 76, 113, 120, 187, 211, 286
Akudnairngmiut, 34
Alaska, 132
Albanel, Charles, 82
Albert, 59, 60
Alderman Jones sound, 78
Aldrich, Lieut, 107
Alert, 106, 107
Alexander, 88
Alexander cape, 44, 88
Alpine Triassic, 188
Amadjuak lake, 123, 162, 212
American whalers, 285
Ami, H. M., fossils, 211, 329
Amphitrite, 100
Amund Ringes, 226
Anautelik, 167
Anderson, John, 101
Anderson island, 244
Angeakatille, 170
Angekok, 163, 164, 169, 172, 173
Angello, Baptista, 73
Anian strait, 72, 84
Anorthosites, 192
Apatite, 200
Archæan 115, 127, 184, 186, 190-209, 211-220
Archer, Lieut., 107
Archer fiord, 107, 228
Arctic, 70, 251
Arctic circle, 43, 77
Arctic ice—
  Smith sound, 45
  Cape Sabine, 48
  Kennedy channel, 64
  drift, 111
Arctic islands, The—
  description and geology of, 112-130
Arctic Research—
  historical summary of, 71-111
  amount expended on, 102
Arctic trout, 11
  salmon, 59, 157
Armstrong, Dr., 225, 226, 230
Arsenopyrite, 238
Asbestus, 198
Assistance, 99, 100
Atholl cape, 44
Austin, Capt. Horatio, 99, 102
Axel Heiberg island, 114, 129, 226

Bache peninsula, 186
Back, Capt. R. W., 90, 93, 95, 190
Back river, 136
Baffin, William, 77, 78, 103, 249
Baffin bay, 99, 102, 113-121, 185, 186
  currents, 290, 291
  fisheries, 249, 253, 255, 271
  shipping fatalities, 255
Baffin island, 13, 59, 73, 113-116, 120-123,
  geology, 185-189, 200-203, 211, 233-239, 246
  Eskimos, 58, 134, 136
Baird bay, 198
Baker lake, 21
Balaena, 60, 258
Banks island, 99, 100, 114
  geology, 115, 125, 205, 213, 222, 226
Baring island, 223, 224, 230
Barlow, Dr., 231
Barlow, Capt., 84
Barrow, Sir John, 88
Barrow strait, 54, 113, 114, 128
Bartlett, Capt., 23, 70
Bathurst island, 89, 114, 129
  geology, 223-226, 247
Bayly, Charles, 81
Beaches, 189, 206
Beacon island, 26
Bears, 16, 58, 65, 128
Beaumont, Lieut., 107, 108
Beechey, Capt., 92.
Beechey island, 2, 51, 52, 103, 221
  fossils, 322, 329
Belcher, Capt. Sir Ed., 101, 102
Belcher channel, 110
Bell, Dr. R., 184, 190, 191, 199, 201, 202, 231, 234, 240
Bell island, 18
Belle Isle strait, 6
Bellot strait, 124, 214
Bering sea, 99, 111
  strait, 99, 100, 114
Bernier, Capt., 70

Beryl, 198
Bibliography, Appen. V.
Big island, 40, 118, 122, 137
  geology, 201, 202
Big seal, 280
Biotite, 209
Bird, Capt. E. J., 99
Birds, 76, 127, Appen. II.
Blaamanden, 227
Blacklead island, 8, 9, 62, 204
Blue crane, 34
Boas, Dr. Franz, 133, 134, 163, 201, 212
Bonaventure, 83
Booth, Sir Felix, 92
Boothia peninsula, 124
  geology, 205, 213, 214
Borden, Dr., 28, 32, 60
  botany, 320
  meteorology, Appen. I.
Boring machine, 29
Bornite, 200
Botany, Appen. III.
Boulders, 205, 206, 229, 230
  clay, 8, 19, 43
  drift, 81
Bourdon, Jean, 82
Bowell island, 21
Bowhead whale, 249
Brainard, Lieut., 227,228
Breadalbane, 100
British whalers, 249, 250
Brooke Cobham (Marble island), 79
Burgomaster gulls, 51
Button, Sir Thomas, 76, 77
Button islands, 7, 76
Button point, 57, 59
Byam Martin channel, 89
  island, 114, 223, 224
Bylot, —, 76, 77
Bylot island, 56, 58, 59, 113, 115, 123
  geology, 200, 205, 229, 246

Cabot, Sebastian, 72
Cabot strait, 6
Calc-spar, 198
Caldwell, G. F., 29, 31, 191-195, 245, 300
  meteorology, 300
Cambrian, 186, 193, 215, 226, 230
Cambridge bay, 99, 102
Cambro-Silurian, 184, 186, 187, 211
Cape Chidley, 6, 70, 76, 139, 211
  fossils, 327, 336
Cape Haven, 9, 12, 63
Cape of God's Mercy, 74
Cape Rawson series, 226, 228
Carboniferous, 115, 125, 126, 128, 184,
    188, 221, 222, 225, 246
  lower, 213
Caribou, 23, 126, 127, 128, 159
  hunting, 27
Carnelian, 206
Cary islands, 78, 88
Carys Swans Nest, 76, 79
Chalcopyrite, 238
Charles island, 14, 38, 113-118 190, 191,
  287
Charleton island, 79
Charting—
  Frobisher bay, 104
  Jones sound, 110, 111
Chert, 193
Chesterfield inlet, 2, 20, 22, 86, 87, 135,
  195-198, 232, 288
Chidley, John, 74
Chippewyan Indians, 133
Chouart, *dit* Groseilliers, 80, 81
Christianity, 139
Christopher, Capt., 86
Chromic ore, 198
Churchill, 131, 135, 198, 284, 287, 288,
  297, 298
Churchill river, 79, 85
Clarence cape, 54
Clarke island, 244
Clay, 59, 188, 228, 288
  ironstone, 223, 224
  slate, 198, 213
Climate, 126, 188, 253
Clyde river, 120
Coal, 116, 129, 200, 222-228, 240, 247
Coats, Capt. W., 132
Coats island, 17, 68, 76, 113, 119, 120,
  187, 190, 211, 287.
Coccolite, 198
Cockburn island, 197
Collison, Capt. Richard, 99, 102
Comer, Capt. George, 3, 23, 24, 27, 31,
  32, 69, 135, 136, 163
Comfort cape, 77
Conglomerate, 219
Conical island, 43
Constitution cape, 103
Copper, 230, 237-239
  pyrite, 199
Coppermine river, 87, 90, 98, 230
Corals, 217, Appen. IV.
Corbets (or Rankin) inlet, 87
Cornwallis island, 28, 89, 114, 128-129
  geology, 214, 221-224
Countess of Warwick island, 74
Couture, Sieur de la, 82
Creswell bay, 124
Crew of *Neptune*, xvii.
Crocker bay, 50
  mountains, 88, 89
Crossman, M., 29
Cumberland gulf, 8, 62, 63, 74, 121,
    122, 137, 204, 245
  strait, 200
Cuming creek, 50, 51, 209
Cunningham nord, 77
Currents, 7, 40, 49, 67, 253-255, 288-292,
  295
Cyrus Field bay, 11, 64, 200, 204, 205

Dablon, Claude, 82
Danes, 77
Danish expedition, 79
  settlement, 104
Dangerous point, 22
D'Argenson, Pierre, 9, 82
Davieau island, 242, 244

Davis, John, 74, 75
Davis strait, 102, 120, 185, 200
  currents, 67
  tribes on, 134
  whaling, 249, 253
Dawson, Dr. G. M., 197, 205, 227, 229
Dease, Peter Warren, 93, 94
Deception bay, 38, 66, 67
Dee, Staff-Sergeant, 69
Deer, 21, 58
  hunting, 159, 160
Depot island, 20, 24
De Rance, 214, 216, 225, 226
Desire Provoketh (Akpatok island), 76
Devil's Thumb island, 42
Devonian, 116, 129, 187, 188, 213, 219 221, 222
  Upper, 220
Diabase, 198, 199, 204, 207, 215, 237, 238
Diallage, 198
Diana, 59, 60, 255
Diatoms, 257
D'Iberville, 83
Diers cape, 74
Digges, Sir Dudley, 75
Digges cape, 76, 78
Digges island, 16, 37
Dikes, 193, 197, 207, 237
Diligence, 100
Discovery, 75, 100, 107
Discovery bay, 108
  harbour, 106
Disko island, 41, 88, 109, 207, 227
Dobbs, Arthur, 85, 86, 89
Dogs, 142-145
Dog-sled, 146-148
Dolomite, 185, 193
Dominoe, 6
Douglas, Admiral Sir A. L., 2
Douglas harbour, 14, 38, 65, 191, 194
Drift, 229-231
Driftwood, 290
Ducks, 79, 157
Duck islands, 42
  mountains, 231
Duncan, Capt., 87
Dundee, 250
Duquet, Sieur, 82
Durban cape, 200
  island, 229
Dutch whaler, 249

Eclipse, 59, 255
Economic minerals, 197, 236-247, 296
Eggs, sea fowl, 157, Appen. II.
Eglinton island, 114, 128
Eider ducks, 158
Eifrig, Rev., 314
Ellef Ringnes, 114, 129, 226
Ellesmere island, 47-49, 104, 108, 110-116, 126, 127, 236, 246, 184-189, 207, 215, 222-227, 234, 236, 246
Elliott, Lieut., 100
Emerson, Prof. B. K., 200
Enterprise, 99.
Era, 3, 69, 265,-267
Erebus, 95, 96, 101
Erebus harbour, 52, 54
Erik cove, 15, 16, 37
  harbour, 57, 60, 61, 234
Erratics, 224, 230, 231
Eskimos—
  areas inhabited by, 131
  Baffin island population, 57, 58
  clothes, 177-180
  customs, 141, 165-169, 174-177
  character, 136, 138, 163, 170, 171, 182, 272
  dwellings, 45, 60, 142-145, 153, 154
  education, 139, 140
  food, 145, 181, 261
  history, 66, 73-78, 87, 132, 133
  population, 131-141
  physical condition, Appen. VI.
  religion, 9, 138, 139
Esquimaux cape, 198
Etah, 44, 45
Evans strait, 18, 39, 120
Exeter sound, 74
Exmouth island, 226

Faribault, Dr. G. B., 28, 30
Fauna, 216
Fawckner, William, 100
Feilden, Capt., 214, 216, 227
Feldspar, 190, 195, 201, 204
Felix, 99
Fish, 76, 79
Fish river, 98
Fisher, Mr., 285
Fisher bay, 194
Fisheries, 296, 297
  See also 'Whaling and Seals.'
Fisher strait, 39, 120
Flint island, 241
Floeberg beach, 106, 108
Flora, Appen. III.
Fog, 41, 42, 48, 54, 56, 60, 64, 294
Ford, H., 7
Forestry, 296, 297
Forsyth, Capt. C. C., 99
Fort Churchill, 87
Fort Conger, 247
Fort Rupert, 81
Fossils, 51, 186, 187, 201, 210-228, 234, Appen. IV.
  plants, 188, 220
  wood, 226, 228
Foulke fiord, 104, 208
Fox, Capt. Luke, 79, 80, 284
Fox, 101.
Fox channel, 16, 67, 79, 86, 89, 119-122 136, 197, 256
Fox hunting, 151
Fram, 71, 110, 129
Franklin, Lady, 96, 99, 100
Franklin, Sir John—
  expeditions, 90, 97
  record of death, 125
  memorial, 52, 53

Franklin Pierce bay, 216
Franklin sound, 107
  strait, 125
Frederick, Capt. Charles, 100
French Fur Co., 65
Frenchman cove, 12
Fresh water pools, 257
Frobisher, Sir Martin, 71-74
Frobisher bay, 13, 64, 73-75, 121-123 200
Fullerton—
  Neptune in winter quarters, 25-34
  Neptune's return to, 69
  ice in harbour, 292-293
  shoals, 26
Fur trade, 296
Fury, 56, 89
Fury beach, 69-93
Fury and Hecla strait, 89, 92, 94, 121, 122

Gaasefjord, 218, 219
Gabbro, 198
Galena, 237
Galena-Trenton, 184, 187
  Lower, 211
Gales, 43, 56, 60-64, 70, 103-105
Gama, Vasco de, 72
Game, 128, 157
Ganoid scales, 219
Garnet, 192-198, 201, 203, 230, 231
Gasteropods, 216
Geese, 127, 157
Geology, 183-287
Geological Survey of Canada—
  work by, in Arctic regions, 341
George river, 140, 191, 192
Gilbert, 21
Gilberts sound, 74
Gillies island, 244
Gillam, Zachariah, 81
Gjoa, 53
Glacial striæ, 185, 230-233
Glaciation, 8, 9, 184, 188, 189, 229-235
Glaciers—
  Disko island, 41, 42
  Parker Snow bay, 43
  Ellsmere island, 49
  Lancaster sound, 50
  North Devon, 51
  Erik harbour, 60, 61
  other references, 116, 122-128, 236, 253, 254
Gneiss, 8, 12, 17, 43, 115, 190-208
Godhaab, 74
Gods Mercies island, 76
Gold, 73, 77, 197, 237
Goldener's Patent, 52, 97
Goodsir, Dr. R. A., 99, 259
Gordon, Commander, 7, 285
Gore, Lieut. Graham, 97
Graham Moore cape, 57
Grain shipment, suggested route, 283, 298
Granite, 185-298
  Cumberland gulf, 8
  Frenchman cove, 12
  Cyrus Field bay, 12
  Seahorse point, 17
  Salisbury island, 67
Granite cape, 297
Graphite, 190-204, 243, 245
Gravel, 188, 288
Gray strait, 7
Great Bear lake, 92
Great Fish river, 93, 94, 101
Great Slave lake, 87, 91, 93
Greely, Capt. A. W., 108, 113, 227, 228, 247
Greene, Henry, 76
Greenland, 74, 75, 77, 109, 110
Greenland whale, 249, 258
Greenstone, 197, 204
Grenville series, 190, 202
Griffin, S. P., 99
Grinnell, Henry, 103
Grinnell glacier, 14, 122
  land, 227, 228
  peninsula, 127, 222
Griper, 88, 94
Gripper shoal, 14
Guelph, 211
Guy, Capt., 3
Gypsum, 212

Halifax, 4, 5, 70
Halkett, Andrew, 314
Hall, Charles F., 104, 105, 200, 202, 251
Hall, James, 77
Hall island, 15, 73
Harbour seal, 278-279
Hares, 125-128
Harp seal, 279, 280
Haughton, Prof., 213, 222-224, 30
Hawkes cape, 104
Haven, Lieut D., 99
Havnefjord, 17
Hayes, Dr. I. I., 103, 104
Hearne, Samuel, 85, 87, 133
Hecla, 89
Heer, Prof., 226, 227
Hell Gate, 218
Hematite, 223, 224
Herald, 99
Herbert island, 44
Herschel cape, 47, 48, 208
Historical Summary of Arctic Research, 71-111
Home bay, 121
Hood, Lieut., 96
Hooded seal, 280
Hope cape, 86
Hopes Advance bay, 193
  cape, 194
Hopes Checked, 76
Hopewell, 75
Hoppner, Capt., 89
Hornblende, 195, 201

Horn sound, 78
Horsbury cape, 50
Hudson, Henry, 75, 76, 82, 284
Hudson's Bay Co.—
  fisheries, 85, 251, 274
  Franklin expeditions, 99-101
  history, 80-87, 92
  posts, 6, 83, 91
  surveys, 93, 94
  trading, 284, 285, 296
Hudson bay—
  depths, 67, 288
  Eskimos, 134, 135
  fisheries, 249, 251, 256, 271, 274, 281
  geology, 185-211
  history, 79-84, 90, 284
  islands, 113, 117, 119
  iron, 239, 240
  ice, 39, 285
  navigation (bay and strait) 283-298
  policing, 3
  resources, 296
  trade, 296
Hudson bay and strait—
  climate, 297
  currents, 73, 288-290
  explorations, 73-89
  fisheries, 259, 296, 297
  glaciation, 231
  ice, 39, 292, 293
  minerals, 237
  navigation, 283-298
Hudson strait—
  Eskimos, 134
  ice, 37, 40, 285, 292
  navigation, 285, 286
  tides, 13
  whaling, 252
Humboldt glacier, 101, 103, 230
Huronian, 184-208, 215, 236-238
Hutchen's goose, 34
Hyalrosfjord, 217

Ice—
  Bylot island, 57
  Coats island, 36
  Cumberland gulf, 61-63
  Fox channel, 67-69, 256
  Fullerton and Port Burwell, 39, 40
  Fury and Hecla strait, 89
  Hudson strait, 37, 40, 285, 292
  Ponds inlet, 59
  Resolution island, 94
  Sabine cape, 45, 47
  Smith sound, 48, 49
  Southampton island, 94
  Whale point, 59
  formation, 292, 294
  movement, 254, 255
  middle pack, 75, 78, 254, 258, 291
Icy cape, 201
Iglulingmiut, 135, 136, 160
Indians, 87, 296
Indra Eide, 218
Inglefield, Capt. E. A., 100, 102
Inglefield gulf, 44
Interpreter, 6
Intrepid, 100
Investigator, 99
Iron ore, 156, 192, 198, 238-245
Iroquois, 82, 132, 133
Isabel, 100, 102
Isabella, 88
Isacksen, 110
Island bay, 196
Itivimiut, 134

Jackson, Capt., 11, 63
Jaegar, 34
James, Capt., 79, 80, 284
Jameson, Prof., 197, 198
James bay, 188, 292
Jenkins, Commander, 100
Jesuits, Relations of, 82
Jones cape, 131
  sound, 88, 103, 111
Joy island, 65
Juet, Robert, 76

Kane, Dr. Elisha Kent, 101, 103
Kane basin, 103, 105
Kaxodliun, 204
Kedlingmiut, 134
Kekerten harbour, 10, 11, 204
Kellett, Capt. Henry, 99, 102
Kelsey, Henry, 84
Kendall, Lieut., 92
Kendall cape, 33
Kenipitumiut, 27, 135, 136, 155, 159, 162-180
Kennedy, William, 100
Kennedy channel, 103, 108
King, C. F., 2, 30
  meteorology, 300
King, John, 76
Kingaite, 200
King cape, 122
King Charles cape, 137
King Charles His Promontory, 79
King Christian island, 114, 129
King George sound, 65
King Oscar island, 226
King William island, 98, 114, 124, 125, 205, 213
Kittoktangmiut, 134
Knight, Capt., 75, 84
Knight, James, 251
Kobbebugten, 217
Koguangmiut, 134
Koksoak river, 274
Koning, 200
Kuamangmiut, 134
Kyaks, 154-156

Labrador Eskimos, 131-135, 138
Lady Franklin, 99
Lady Franklin island, 13
Lake harbour, 68, 236, 245
Lakes, 123, 201
Lake Superior, 193, 240, 243, 245

Lambe, Lawrence M., 211
on Corals, Appen. IV.
Lancaster sound, 50, 88, 93-101
L'Anglois, Jean, 82
Laurentian, 184, 186, 197-209, 236, 237, 246
Leopold, Capt. Francis, 100
Leopold island, 54
Liddon, Lieut. M., 88
Lignite, 188, 226-228, 246
Lockwood, Lieut., 108, 109
Lord Weston's Portland, 79
Low, A. P., viii., ix., xvii.
Lower Heidelberg formation, 211
Lyon, Capt. G. F., 18, 89
Lumlie inlet, 74

McCulloch, Dr., 200
Mackenzie river, 90, 92, 93, 99
McClintock, Admiral Sir F. L., 53 96, 98, 101, 102, 206, 214, 223, 226
McClure, Sir R., 99, 102, 223, 226
McClure strait, 129
McCormick, Dr. R., 100
McCormick bay, 44
Macoun, Prof. J., 314
Macoun, J. M., 320
McTavish island, 242, 244
Magna Britannia, 76
Magnetic Pole, 93, 124
Magnetic iron ore, 198-201, 238
Maguire, Capt. Rochfort, 100
Manitoba, 186, 231
Mansfield island, 36, 37, 69, 77, 113, 187
Mansell island, 77
Marble island, 79, 84, 85
quartzites, 198, 199
Marine shells, 222
terraces, 189, 234-236
Markham, Commander, 107
Matty island, 213
Melville bay, 42, 88, 105
channel, 89
island, 89, 100, 114, 128, 223, 224, 236, 246
peninsula, 197, 211
Mesozoic, 116, 117, 130, 184, 188, 226
Meta Incognita, 73
Meteorological stations, 108, 285
Meteorology, Appen. I.
Mica, 69, 83, 160, 201, 204, 236, 245, 252, 296
Middleton, Capt., 85, 86, 89
Mill islands, 67
Milne, Capt., 3, 59
Miocene, 188, 226, 227
Tertiary, 126, 128
Mission work, 9
Molybdenite, 198, 246
Montreal island, 98, 101
Monumental island, 13
Moodie, Major J. D., 3, 8, 25, 41, 70
Moonshine, 74
Moore, Capt. Thomas, 98
Moravian missionaries, 138, 139
Morton, William, 103
Mudflats, 11
Munck, Jens, 79, 235
Murray, Capt., 3, 68
Muscovy Company of London, 72, 75, 79
Musk oxen, 58, 126, 127, 128

Nachvak bay, 6
Nancy Dawson, 99
Nansen, 109
Nares, Capt. G., 106, 107, 109
Narwhals, 275, 276
Nastapoka islands—
iron ores, 240, 254
Nastapoka river, 245
Nathorst, Prof., 220
Navigation—
Hudson bay, 16-24, 35-37, 283-296
strait, 13-16, 37-40, 283-296
Lancaster sound, 50
Melville bay, 45
Ponds inlet, 57
Port Burwell to Cumberland gulf, 8-13
Port Burwell to Fullerton, 64-69
Port Leopold, 54
Smith sound, 44
Navy Board inlet, 120
Nechilliks, 135, 136, 138, 160, 164
Nelson river, 76, 84
Neptune, officers and crew, xvii
description, 3-5
mishap off Cape Herschel, 47
recall, 70
summer cruise, 35-70
winter quarters, 25-34
voyage north, 524
Netilling lake, 123
Newfoundland seal fishery, 291
Niagara, 211, 221
Nimrod, 251
Noble, Mr., 10, 11
Norman Lockyer island, 216
North Devon, 50, 51, 89, 114, 115, 127, 207, 208, 220, 222
North Pole, 126
North Omenak, native caches, 103
North Somerset island, 89, 114, 124, 205, 214
North Star, 99, 100
Northumberland island, 44
North-West Company, 87, 90, 92
grain fields, 283, 284
Passage, 75, 86, 88, 89
North-West Mounted Police, List of, xvii.
Norton, Mr., 86, 87
Norway, 273
Norwegian expedition, 53, 129
Nottingham island, 113-119, 137, 190, 191
Nugumiut, 134, 136
Nuliayok, 167, 168, 169, 172
Nuvungmiut, 134
Nye Hernhut, 74

Observation stations, 108, 285
O'Connel, James, 29
Officers of *Neptune*, xvii.
Okomingmiut, 134
Okommiut, 134
Ommaney, Capt., 99
Osborn, Lieut. Sherard, 100
Ouhowjawtil, 190

Padlimiut, 135, 160
Palaeozoic, 115, 116, 126, 184, 188, 221
Paleocrystic ice, 106
Parker Snow bay, 43
Parr, Lieut., 107
Parry, Sir W. E., 88-90, 129, 136, 190, 197, 211, 214, 224, 246
Parry cape, 44, 103
Parry islands, 114-116, 129, 184, 226, 246
Payer harbour, 45
Payne river, 193
Peabody, George, 103
Peary, Lieut. R. E., 45, 46, 109, 110, 113
  expedition, 201
Peck, Rev. J., 3, 9, 62, 65, 137, 163
Peel sound, 101, 124
Pegmatite, 190, 192, 195
Penny, William, 99
Perseverance, 251
Perthite, 205
Petiwik glacier, 43
Philpot island, 50, 208
Phœnix, 100
Pilot, 57, 65
Pioneer, 100
Plants, 51, 60, Appen. III.
Plover, 98, 100
Polaris, 104, 105, 230
Police, North-West Mounted, xvii.
Ponds inlet, 57, 117, 121
Porphyry, 198
Porpoises, 274-276
Port Burwell, 6, 8, 38, 41, 64
Port de Boucherville, 191
Port Logan, 213
Port Leopold, 54-56
Post-Glacial, 184
Post-Tertiary, 229-234
Potter and Wrightington, Messrs, 12
Prefontaine, Hon. Raymond, 4
  cape, 36
Pricket, Abacuk, 76
Prince Albert, 99, 100
Prince Arthur island, 100
Prince Henry, 77
Prince of Wales island, 114, 125, 205 207, 214
Prince Patrick island, 114, 129, 226
Prince Regent inlet, 56, 120-124
Princess Royal island, 223, 230
Promise island, 21, 24
Proteus, 108, 109
Pukimma, 168
Pullen, Capt. W. J. S., 99, 100
Pyrite, 31, 190-204, 238

Quartzite, 198, 199
Quartz, smoky, 190
Queen Elizabeth, 72
  foreland, 73

Radisson, 80, 81
Rae, Dr. John, 94, 98-99, 100, 102, 197, 213, 237, 251
Ranken inlet, 135
Red phalarope, 34
Reefs and shoals—
  Cyrus Field bay, 12, 13
  Fox channel, 256
  Fullerton, 26
  Kendall cape, 34
  Winchester inlet, 19
Regent inlet, 93, 100, 102
Rendalen, 217
Rensselaer bay, 103
Repulse bay, 68, 85, 89, 100, 105, 107, 138
Reserve, 99
Resolute, 99, 100
Resolution island, 13, 75, 95, 113, 118, 118, 190, 191
Revillon Fur Co., 284, 296
Rhomb-spar, 198
Richardson, Sir John, 98, 101
Richardson, Dr., 90, 92
Right whale, 123, 246, 249
Ringed seal, 279
Robeson channel, 107
Rock crystal, 198
Rocky mountains, 92
Roes Welcome, 26, 33, 79
Ross, Capt. Sir James Clark, 93, 99, 213
Ross, Rear Admiral Sir John, 88, 90-93, 99
Ross, Mr., 30
Rosse bay, 47
Rupert river, 81
Ryswick, Treaty of, 83

Sabine cape, 45, 208
Sabine's gull, 34
Saddle-back islands, 14
Sagdlingmiut, 138
Saguenay river, 82
St. Paul island, 6
Salisburies Foreland, 76
Salisbury island, 66, 113-119, 190, 191
Salmon, 59, 140
Salmon river, 203
Sandstone, 185, 193, 206-227
Saskatchewan river, 84, 87
Saunders, James, 99
Sausserite, 238
Scenery, 6, 41, 56, 57, 127, 202
Schel, P., 184, 186, 189, 214-226, 234 235
Schuchert, C., 201
Scoresby, Capt., 88
Scott inlet, 121
Scotty, 21
Scroggs, John, 84

Scurvy, 107, 108
Seaford, 83
Seahorse point, 16, 17, 77
Seal river, 198
Seals, 44, 51, 149-152, 157, 278-280
Sedlingmiut, 134
Sedna, 167
Serpentine, 198
Shannuktungmiut, 135, 136
Shedden, Robert, 99
Sherard Osborne fiord, 107
Shoals. *See also* 'Reefs'—
  Cape Haven, 12
  Chesterfield inlet, 21, 288
  Hudson bay, 288
  Wakeham bay, 64
Sikosilingmiut, 134, 137, 160
Sillimans Fossil Mount, 201, 212
Silurian, 115, 120-128, 187, 190, 201, 206, 210-221
  Lower, 200, 216
  Middle, 217, 220
  Upper, 296, 217, 222
Silver, 237
Simpson, Thomas, 93, 94
Sinimiut, 136
Sir James Lancaster sound, 78
Sir Thomas Roes Welcome. *See* 'Roes Welcome.'
Skrabdalen, 218, 219
Slate, 228
Smith, Sir Thomas, 78
Smith sound, 88, 101-110, 185
Snow goose, 34
Snow-houses, 142-144
Soapstone, 144, 145
Sophia, 99
Southampton island, 16, 33, 34, 77, 79, 86, 113, 115, 119, 187, 190, 210, 211
  fossils, 325, 331, 335
Sovereign Council of Quebec, 82
Specular iron, 193, 198
Spicer harbour, 137
Spring explorations, 30, 31
Stein expedition, 46
Stephenson, Capt., 106
Stewart, Rev., 139
Stewart, Alex., 99
Strom, 65
Sugluk bay, 66, 194
Sulphides, 194
Sunshine, 74
Surveys, 48, 51, 66, 92, 93, 94, 107, 195
Sutherland, Dr. P. C., 200, 207, 208
Sverdrup, Capt., 71, 110-113, 128, 214, 215
  islands, 114, 116, 129, 184, 188
Swan, whistling, 34
Syenite, 191

Talbot, 100
Talus, 233
Taylor island, 244
Tern, Arctic, 34
Terror, 95, 96, 101
Tertiary, 116, 117, 184, 185, 226-229, 246, 247
Tides—
  Blacklead, 62, 63
  Chesterfield inlet, 22
  Cyrus Field bay, 13
  Deception bay, 66
  Hudson strait, 13, 40, 74
  Wolstenholme cape, 67
  Ungava bay, 7
Tom island, 18
Tourmaline, 198
Trading returns—
  Cumberland gulf, 63, 64, 68
  Repulse bay, 68
Transition valley, 206
Trap, 185, 194-208
Tree limit, 135
Trees, 125, 126
Tremolite, 198
Trilobites, 216
Troyes, Chevalier, 83
Tunungmiut, 134
Tunurusungmiut, 134
Tyrrell, J. B., 31, 190, 198, 231, 232, 237, 238

Ungava bay—
  fishery, 274
  geology, 191-193
  graphite, 245
  iron ores, 239
  tides, 7
United States expeditions, 102
  mountains, 126
United States, 104
Upernivik, 42, 104, 108
Utrecht, Treaty of, 83, 84, 285

Vallière, Druillette de, 82
Van Hise, 243
Vaugnan, Capt., 84
Vega, 225
Vegetation, 12, 33-37, 51, 52, 58, 60, 123, 128, 202, 227
Victoria island, 99, 114, 205, 213, 222
Victory, 92, 93
Vœux, Charles des, 97

Wager inlet, 85, 197, 237
Wakeham, Commander, 285
Wakeham bay, 64, 194
Walker cape, 89
Walrus, 44, 51, 58, 65, 78, 128
  description of, 280-282
  hunt, 14, 15
Walrus island, 18
Walsingham cape, 74, 75
Warwicks foreland, 74
Weggs cape, 14, 65
Wellington channel, 97, 100
Weymouth, George, 75
Whalebone, 84

Whales, 11, 124
general description of, 256-261
whalebone, 249, 260
Whaling, 248-278
statistics of catch, 272
of British fleet, 277
of American, 277, 278
stations, 8-12, 32, 58, 78, 136-138, 160 271
Whale point, 32, 196, 232
river, 237
sound, 44
White sea, 284
Wittersted lake, 214
Winnipeg basin, 187, 188, 210
lake, 87
Winter island, 89
Winchester inlet, 19, 20, 31, 195, 196
Wind register, 43
Windward, 46, 55
Wollaston islands, 56
Wolstenholme, Sir John, 75
Wolstenholme cape, 66, 190, 192, 245
Wolstenholm island, 44
sound, 99

York cape, 42, 88, 104
Factory, 90, 94

Zircon, 198

BOSTON PUBLIC LIBRARY
3 9999 02612 302 4

WITHDRAWN
No property
Boston Public Library
Sale of this material benefits the Library.

Boston Public Library
Central Library, Copley Square

Division of
Reference and Research

F1060.9
.C221

The Date Due Card in the pocket indicates the date on or before which this book should be returned to the Library.

Please do not remove cards from this pocket.

AUG 1 0 1960